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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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CHEMISTRY AND MATERIALS

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Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
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89 ASTRONOMY 706
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 707
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 708
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **N.A.**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **N.A.**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 710

Note: N.A. means that no abstracts were assigned to this category for this issue.

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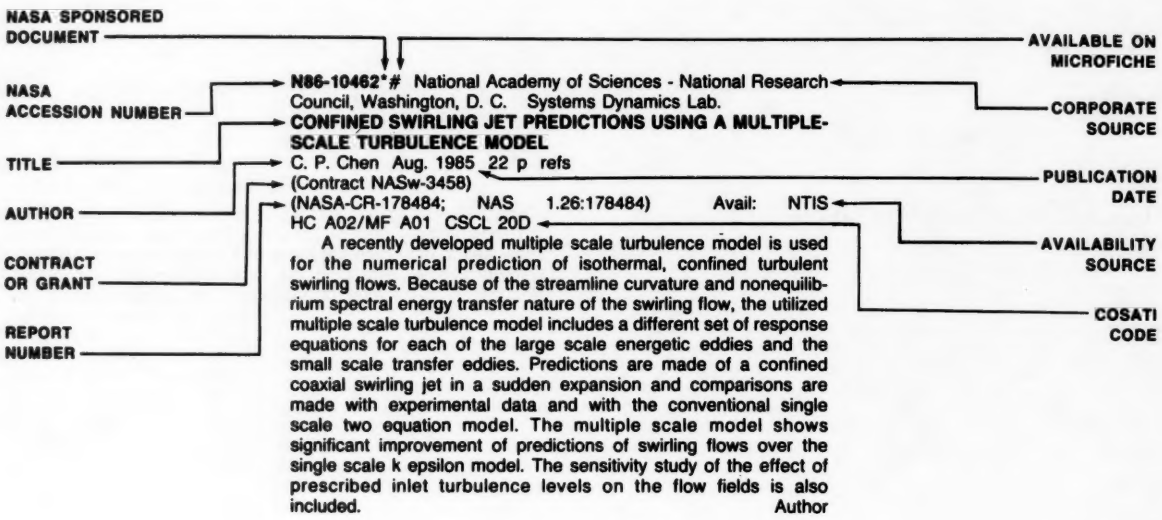
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

VOLUME 24 NUMBER 4 / FEBRUARY 23, 1986

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-13286*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASSESSMENT OF AERODYNAMIC AND DYNAMIC MODELS IN A COMPREHENSIVE ANALYSIS
Wayne Johnson Oct. 1985 39 p refs
(NASA-TM-86835; Rept-85047; NAS 1.15:86835) Avail: NTIS HC A03/MF A01 CSCL 01B

The history, status, and lessons of a comprehensive analysis for rotorcraft are reviewed. The development, features, and capabilities of the analysis are summarized, including the aerodynamic and dynamic models that were used. Examples of correlation of the computational results with experimental data are given, extensions of the analysis for research in several topics of helicopter technology are discussed, and the experiences of outside users are summarized. Finally, the required capabilities and approach for the next comprehensive analysis are described.
Author

N86-13618# Joint Publications Research Service, Arlington, Va.
ATR 42 PRODUCTION WORK IN FRENCH, ITALIAN PLANTS DETAILED
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 14-19 Repr. from Rev. Aerospatiale (France), Oct. 1985 p 16; 18; 20; 22; 27 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-13287*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
EFFECTS OF VELOCITY PROFILE AND INCLINATION ON DUAL-JET-INDUCED PRESSURES ON A FLAT PLATE IN A CROSSWIND
A. L. Jakubowski, J. A. Schetz, C. L. Moore, and R. Joag Oct. 1985 52 p refs
(Grant NAG2-256)
(NASA-CR-177361; NAS 1.26:177361) Avail: NTIS HC A04/MF A01 CSCL 01A

An experimental study was conducted to determine surface pressure distributions on a flat plate with dual subsonic, circular jets exhausting from the surface into a crossflow. The jets were arranged in both side-by-side and tandem configurations and were injected at 90 deg and 60 deg angles to the plate, with jet-to-crossflow velocity ratio of 2.2 and 4. The major objective of the study was to determine the effect of a nonuniform (vs uniform) jet velocity profile, simulating the exhaust of a turbo-fan engine. Nonuniform jets with a high-velocity outer annulus and a low-velocity core induced stronger negative pressure fields than uniform jets with the same mass flow rate. However, nondimensional lift losses (lift loss/jet thrust lift) due to such nonuniform jets were lower than lift losses due to uniform jets. Changing the injection angle from 90 deg to 60 deg resulted in moderate (for tandem jets) to significant (for side-by-side jets) increases in the induced negative pressures, even though the surface area influenced by the jets tended to reduce as the angle decreased. Jets arranged in the side-by-side configuration led to significant jet-induced lift losses exceeding, in some cases, lift losses reported for single jets.
B.W.

N86-13288# National Aerospace Lab., Tokyo (Japan).
A METHOD FOR CALCULATING FLOW FIELDS AROUND MOVING BODIES
Sataru Ogawa and Tomiko Ishiguro May 1985 23 p refs
(NAL-TR-859T; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

A new method for calculating flow fields with arbitrarily moving boundaries is proposed. Under the concept of Lie derivative, field equation moving coordinates are derived. There are several kinds of such equations; an example is one written in Viviand's conservative form. According to the formulation presented, it is natural and reasonable to consider that the computation coordinates fitted to the body move in space. This is the reverse of the usual computational procedures. The two dimensional incompressible Navier-Stokes equations in general moving coordinates are solved by a finite difference method. Using the third-order upwind scheme (Kawamura scheme), the present calculations are made for the dynamic stall process on an oscillating airfoil, and the flow generated by a moving cylinder. Consequently it is shown that the flow generated by a moving body can easily be analyzed by the present method.
Author

N86-13289*# Santa Clara Univ., Calif. Dept. of Physics.
WIND TUNNEL SIMULATIONS OF AEROLIAN PROCESSES Final Technical Report, Mar. 1980 - Nov. 1984
Ronald Greeley 31 Dec. 1984 19 p refs
(Contract NCC2-60)
(NASA-CR-176382; NAS 1.26:176382) Avail: NTIS HC A02/MF A01 CSCL 01A

The characteristics of aerolian (wind) activity as a surface modifying process on Earth, Mars, Venus, and appropriate satellites was determined. A combination of spacecraft data analysis, wind tunnel simulations, and terrestrial field analog studies were used to determine these characteristics. Wind tunnel experiments simulating Venusian surface conditions demonstrate that rolling of particles may be an important mode of transport by winds on Venus and that aerolian processes in the dense atmosphere may share attributes of both aerolian and aqueous environments on Earth.
Author

N86-13290*# Informatics General Corp., Palo Alto, Calif.
DAB USER'S GUIDE
Jeff Trosin Nov. 1985 20 p
(Contract NAS2-11555)
(NASA-CR-177393; NAS 1.26:177393; TN-85-7104-306-26) Avail: NTIS HC A02/MF A01 CSCL 01A

Use of the Display AButments (DAB) which plots PAN AIR geometries is presented. The DAB program creates hidden line displays of PAN AIR geometries and labels specified geometry components, such as abutments, networks, and network edges. It is used to alleviate the very time consuming and error prone abutment list checking phase of developing a valid PAN AIR geometry, and therefore represents a valuable tool for debugging complex PAN AIR geometry definitions. DAB is written in FORTRAN 77 and runs on a Digital Equipment Corporation VAX 11/780 under VMS. It utilizes a special color version of the SKETCH hidden line analysis routine. Author

N86-13291*# Informatics General Corp., Palo Alto, Calif.
PLTTER USER'S GUIDE
Alice Barlow, Dexter Hermstad, and Jeff Trosin Nov. 1985 64 p
(Contract NAS2-11555)
(NASA-CR-177385; NAS 1.26:177385; TN-85-7104-306-23) Avail: NTIS HC A04/MF A01 CSCL 01A

The PLTTER graphics system, which is part of CDDMS is discussed. CDDMS is a comprehensive system for data basing and subsequent plotting of data acquired during wind tunnel tests or from computational flow analyses. The PLTTER is a system which creates report-quality plots of data which is stored on a CDDMS data base. The Requests file system allows plot-controlling information to be arranged in the way which is most appropriate for any application. The PLTTER system features many capabilities which are especially useful when plotting wind tunnel data. The PLTTER offers a variety of page formats, different grid options and parametric curve fitting algorithms, and a powerful legend capability to identify relevant information about individual curves. One or more plots on a page can be suppressed if desired so that an established page format can be maintained. Final plot output may be standard Versatec plots, QMS Laser printer plots, or microfiche. E.A.K.

N86-13292*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON APPLICATIONS OF CHIMERA GRID SCHEMES TO STORE SEPARATION
F. Carroll Cougherty, John A. Benek (Calspan Field Services, Arnold Air Force Station, Tenn.), and Joseph L. Steger Oct. 1985 14 p refs
(NASA-TM-88193; Rept-86045; NAS 1.15:88193) Avail: NTIS HC A02/MF A01 CSCL 01A

A finite difference scheme which uses multiple overset meshes to simulate the aerodynamics of aircraft/store interaction and store separation is described. In this chimera, or multiple mesh, scheme, a complex configuration is mapped using a major grid about the main component of the configuration, and minor overset meshes are used to map each additional component such as a store. As a first step in modeling the aerodynamics of store separation, two dimensional inviscid flow calculations were carried out in which one of the minor meshes is allowed to move with respect to the major grid. Solutions of calibrated two dimensional problems indicate that allowing one mesh to move with respect to another does not adversely affect the time accuracy of an unsteady solution. Steady, inviscid three dimensional computations demonstrate the capability to simulate complex configurations, including closely packed multiple bodies. Author

N86-13293*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
NUMERICAL SOLUTIONS OF NAVIER-STOKES EQUATIONS FOR A BUTLER WING Progress Report, 1 Jan. - 31 Aug. 1985
Jamshid S. Abolhassani and S. N. Tiwari Oct. 1985 50 p refs
(Contract NCC1-68)
(NASA-CR-174202; NAS 1.26:174202) Avail: NTIS HC A03/MF A01 CSCL 01A

The flow field is simulated on the surface of a given delta wing (Butler wing) at zero incident in a uniform stream. The simulation is done by integrating a set of flow field equations. This set of equations governs the unsteady, viscous, compressible, heat conducting flow of an ideal gas. The equations are written in curvilinear coordinates so that the wing surface is represented accurately. These equations are solved by the finite difference method, and results obtained for high-speed freestream conditions are compared with theoretical and experimental results. In this study, the Navier-Stokes equations are solved numerically. These equations are unsteady, compressible, viscous, and three-dimensional without neglecting any terms. The time dependency of the governing equations allows the solution to progress naturally for an arbitrary initial initial guess to an asymptotic steady state, if one exists. The equations are transformed from physical coordinates to the computational coordinates, allowing the solution of the governing equations in a rectangular parallel-piped domain. The equations are solved by the MacCormack time-split technique which is vectorized and programmed to run on the CDC VPS 32 computer. Author

N86-13294*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
AN INVESTIGATION INTO THE VERTICAL AXIS CONTROL POWER REQUIREMENTS FOR LANDING VTOL TYPE AIRCRAFT ONBOARD NONAVIATION SHIPS IN VARIOUS SEA STATES
Mark E. Stevens and Jan Roskam Jul. 1985 216 p
(Contract NCC2-242)
(NASA-CR-176355; NAS 1.26:176355; KU-FRL-623-1) Avail: NTIS HC A10/MF A01 CSCL 01A

The problem of determining the vertical axis control requirements for landing a VTOL aircraft on a moving ship deck in various sea states is examined. Both a fixed-base piloted simulation and a nonpiloted simulation were used to determine the landing performance as influenced by thrust-to-weight ratio, vertical damping, and engine lags. The piloted simulation was run using a fixed-based simulator at Ames Research center. Simplified versions of an existing AV-8A Harrier model and an existing head-up display format were used. The ship model used was that of a DD963 class destroyer. Simplified linear models of the pilot, aircraft, ship motion, and ship air-wake turbulence were developed for the nonpiloted simulation. A unique aspect of the nonpiloted simulation was the development of a model of the piloting strategy used for shipboard landing. This model was refined during the piloted simulation until it provided a reasonably good representation of observed pilot behavior. B.W.

N86-13295*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FORTRAN COMPUTER CODE FOR CALCULATING FLOWS IN MULTIPLE-BLADE-ELEMENT CASCADES
Eric R. McFarland Nov. 1985 29 p refs
(NASA-TM-87104; E-2701; NAS 1.15:87104) Avail: NTIS HC A03/MF A01 CSCL 01A

A solution technique has been developed for solving the multiple-blade-element, surface-of-revolution, blade-to-blade flow problem in turbomachinery. The calculation solves approximate flow equations which include the effects of compressibility, radius change, blade-row rotation, and variable stream sheet thickness. An integral equation solution (i.e., panel method) is used to solve the equations. A description of the computer code and computer code input is given in this report. Author

N86-13296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTATIONAL ASPECTS OF ZONAL ALGORITHMS FOR SOLVING THE COMPRESSIBLE NAVIER-STOKES EQUATIONS IN THREE DIMENSIONS
Terry L. Holst, Scott D. Thomas (Informatics General Corp., Palo Alto, Calif.), Unver Kaynak, Karen L. Gundy, Jolen Flores, and

Neal M. Chaderjian Oct. 1985 15 p refs
(NASA-TM-86774; Rept-85340; NAS 1.15:86774) Avail: NTIS HC A02/MF A01 CSCL 01A

Transonic flow fields about wing geometries are computed using an Euler/Navier-Stokes approach in which the flow field is divided into several zones. The flow field immediately adjacent to the wing surface is resolved with fine grid zones and solved using a Navier-Stokes algorithm. Flow field regions removed from the wing are resolved with less finely clustered grid zones and are solved with an Euler algorithm. Computational issues associated with this zonal approach, including data base management aspects, are discussed. Solutions are obtained that are in good agreement with experiment, including cases with significant wind tunnel wall effects. Additional cases with significant shock induced separation on the upper wing surface are also presented. Author

N86-13297*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A TOMOGRAPHIC TECHNIQUE FOR AERODYNAMICS AT TRANSONIC SPEEDS
George Lee Oct. 1985 11 p refs
(NASA-TM-86766; Rept-85318; NAS 1.15:86766) Avail: NTIS HC A02/MF A01 CSCL 01A

Computer aided tomography (CAT) provides a means of noninvasively measuring the air density distribution around an aerodynamic model. This technique is global in that a large portion of the flow field can be measured. A test of the applicability of CAT to transonic velocities was studied. A hemispherical-nose cylinder afterbody model was tested at a Mach number of 0.8 with a new laser holographic interferometer at the 2- by 2-Foot Transonic Wind Tunnel. Holograms of the flow field were taken and were reconstructed into interferograms. The fringe distribution (a measure of the local densities) was digitized for subsequent data reduction. A computer program based on the Fourier-transform technique was developed to convert the fringe distribution into three-dimensional densities around the model. Theoretical aerodynamic densities were calculated for evaluating and assessing the accuracy of the data obtained from the tomographic method. Author

N86-13298*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DOUBLE-BRANCHED VORTEX GENERATOR
Elizabeth R. Cantwell, Russell V. Westphal, and R. D. Mehta (Stanford Univ., Calif.) Nov. 1985 25 p refs
(NASA-TM-88201; Rept-86064; NAS 1.15:88201) Avail: NTIS HC A02/MF A01 CSCL 01A

In order to assess the suitability of using a double branched vortex generator in parametric studies involving vortex interactions, an experimental study of the main vortex and secondary flows produced by a double branched vortex generator was conducted in a 20-by-40 cm indraft wind tunnel. Measurements of the cross flow velocities were made with a five hole pressure probe from which vorticity contours and vortex parameters were derived. The results showed that the optimum configuration consisted of chord extensions with the absence of a centerbody. Author

N86-13299*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GROUND EFFECTS ON V/STOL AND STOL AIRCRAFT: A SURVEY
Richard E. Kuhn and James Eshleman Nov. 1985 27 p refs
(NASA-TM-86825; A-85356; NAS 1.15:86825) Avail: NTIS HC A03/MF A01 CSCL 01A

The flow fields encountered by jet- and fan-powered Vertical/Short Takeoff and Landing (V/STOL) aircraft operating in ground effect are reviewed and their general effects on the aerodynamic characteristics are discussed. The ground effects considered include: (1) the suckdown experienced by a single jet configuration in hover; (2) the fountain flow and additional suckdown experienced by multiple jet configurations in hover; (3) the ground vortex generated by jet and jet flap configurations in short takeoff and landing (STOL) operation and the associated aerodynamic and hot-gas-ingestion effects; and (4) the change in the downwash at the tail due to ground proximity. After over 30 years of research on V/STOL aircraft, the general flow phenomena are well-known and, in most areas, the effects of ground proximity can be established or can be determined experimentally. However, there are some anomalies in the current data base which are discussed. Author

N86-13300*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
A DIRECT-INVERSE METHOD FOR TRANSONIC AND SEPARATED FLOWS ABOUT AIRFOILS Final Report
Leland A. Carlson Dec. 1985 80 p refs
(Grant NsG-1174)
(NASA-CR-176403; NAS 1.26:176403; TAMRF-3224-85-12) Avail: NTIS HC A05/MF A01 CSCL 01A

A direct-inverse technique and computer program called TAMSEP that can be sued for the analysis of the flow about airfoils at subsonic and low transonic freestream velocities is presented. The method is based upon a direct-inverse nonconservative full potential inviscid method, a Thwaites laminar boundary layer technique, and the Barnwell turbulent momentum integral scheme; and it is formulated using Cartesian coordinates. Since the method utilizes inverse boundary conditions in regions of separated flow, it is suitable for predicing the flowfield about airfoils having trailing edge separated flow under high lift conditions. Comparisons with experimental data indicate that the method should be a useful tool for applied aerodynamic analyses. Author

N86-13301# Royal Aircraft Establishment, Farnborough (England).
STUDIES OF THE FLOW FIELD NEAR A NACA 4412 AEROFOIL AT NEARLY MAXIMUM LIFT
R. C. Hastings and B. R. Williams Dec. 1984 35 p
(AD-A157750; RAE-TM-AERO-2026; DRIC-BR-96009) Avail: NTIS HC A03/MF A01 CSCL 02/4

Measurements made at a Mach number of 0.18 and a chord-based Reynolds number of 4.2 x million on a constant-chord model having a NACA 4412 aerofoil section are described and compared with the results of flow field calculations. Both the experimental arrangement and the difficulties initially experienced in achieving an adequate approximation to two-dimensional flow above the wing are briefly outlined. The measurements include static pressure distributions on the wing surface and on the wind tunnel walls above and below the mid-span section of the wing. The main emphasis in the experiment was, however, on defining the development of the upper surface boundary layer through separation (at about 20% chord ahead of the trailing-edge) and on into the wake, making extensive use of laser anemometry. The flow field calculations are the semi-inverse kind in which an inverse momentum-integral treatment of the shear flow, used to avoid difficulties at separation, is coupled to a direct solution of the inviscid flow problem. The main features of the method are outlined. GRA

N86-13302# Royal Aircraft Establishment, Bedford (England).
RECENT EXPERIENCE IN THE RAE (ROYAL AIRCRAFT ESTABLISHMENT) 5-METRE WIND TUNNEL OF A CHINA CLAY METHOD FOR INDICATING BOUNDARY LAYER TRANSITION
I. R. M. Moir Aug. 1984 11 p
(AD-A157943; RAE-TM-AERO-2007; DRIC-BR-94478) Avail: NTIS HC A02/MF A01 CSCL 14/2

The china clay method is based on the differential rate of evaporation, beneath laminar and turbulent boundary layers, of a liquid absorbed on a solid spread on the surface. The liquid is chosen to have a similar refractive index to the solid so that the mixture appears to be transparent until evaporation has taken place, when the color of the solid becomes visible. The solid layer consists of china clay powder mixture with certain chemicals to form a lacquer, which is sprayed onto the surface. When dry, this forms a semi-permanent white absorbent film. A suitable liquid sprayed on to this film is absorbed by it, causing it to become transparent. Details of a visual method for indicating boundary layer transition are given, with particular reference to tests at high Reynolds number in the RAE 5-meter pressurized low-speed wind

tunnel on a slender-body model. The method is compared with other techniques on the basis of ease of use and quality of the indication. GRA

N86-13303# Institut de Mecanique des Fluides de Lille (France).
STUDY OF THE INFLUENCE OF AN OSCILLATING SPOILER ON THE SURROUNDING AERODYNAMIC FIELD [ETUDE DE L'INFLUENCE D'UNE PROTUBERANCE DE PAROI OSCILLANTE SUR LE CHAMP AERODYNAMIQUE ENVIRONNANT]
O. Rodriguez and J. M. Desse 12 Nov. 1984 69 p refs In FRENCH
(Contract DRET-83-250)
(IMFL-3119) Avail: NTIS HC A04/MF A01

Transonic wind tunnel tests were carried out on a wall protuberance vibrating with sinudoidal oscillations. The experiments studied spoiler efficiency. The unsteady phenomena following the sinusoidal excitation were studied by ultrafast visualization and by unsteady pressure measurement on the obstacle. The free stream Mach number was 0.5. Spectrum analysis proves the nonlinear nature of the flow. The dimension of the separated flow region varies with the position of the spoiler on the body. The results show that at the frequences considered the response to the oscillations can be studied in steady flow tests. Author (ESA)

N86-13304*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRESSURE-DISTRIBUTION MEASUREMENTS ON A TRANSONIC LOW-ASPECT RATIO WING
Earl R. Keener Sep. 1985 77 p refs
(NASA-TM-86683; Rept-85131; NAS 1.15:86683) Avail: NTIS HC A05/MF A01 CSCL 01A

Experimental surface pressure distributions and oil flow photographs are presented for a 0.90 m semispan model of NASA/Lockheed Wing C, a generic transonic, supercritical, low aspect ratio, highly 3-dimensional configuration. This wing was tested at the design angle of attack of 5 deg over a Mach number range from 0.25 to 0.96, and a Reynolds number range from 3.4 x 1,000,000 to 10 x 1,000,000. Pressures were measured with both the tunnel floor and ceiling suction slots open for most of the tests but taped closed for some tests to simulate solid walls. A comparison is made with the measured pressures from a small model in high Reynolds number facility and with predicted pressures using two three dimesional, transonic full potential flow wing codes: design code FLO22 (nonconservative) and TWING code (conservative). At the given design condition, a small region of flow separation occurred. At a Mach number of 0.82 the flow was unseparated and the surface flow angles were less than 10 deg, indicating that the boundary layer flow was not 3-D. Evidence indicate that wings that are optimized for mild shock waves and mild pressure recovery gradients generally have small 3-D boundary layer flow at design conditions for unseparated flow. Author

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-13305*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED EMERGENCY OPENINGS FOR COMMERCIAL AIRCRAFT
Laurence J. Bement and Morry L. Schimmel Nov. 1985 18 p refs Presented at the 30th Corporate Aviation Safety Seminar, Dallas, Texas, 14-16 Apr. 1985
(NASA-TM-87580; L-16012; NAS 1.15:87580) Avail: NTIS HC A02/MF A01 CSCL 01C

Explosively actuated openings in composite panels are proposed to enhance passenger survivability within commercial aircraft by providing improvements in emergency openings, fuselage venting, and fuel dump. The concept is to embed a tiny, highly stable explosive cord in the periphery of a load-carrying composite panel; on initiation of the cord, the panel is fractured to create a well-defined opening. The panel would be installed in the sides of the fuselage for passenger egress, in the top of the fuselage for smoke venting, and in the bottoms of the fuel cells for fuel dump. Described are the concerns with the use of explosive systems, safety improvements, advantages, experimental results, and recommended approach to gain acceptance and develop this concept. Author

N86-13306* Ecosystems International, Inc., Crofton, Md.
NASA FLIGHT OPERATIONS REVIEW Final Report
Sep. 1985 113 p Sponsored by NASA
(NASA-CR-176393; NAS 1.26:176393) Avail: Issuing Activity CSCL 01C

Independent assessments of the provisions taken by NASA to assure the safety of their aviation operations are reported. Aviation operations conducted at the Lewis Research Center (LeRC) are reviewed. These reviews and independent assessments were undertaken as part of an on-going effort to provide NASA management with a qualitative evaluation of the overall organizational structure, administrative policy. A report which provides NASA management with a broad overview of the current status and safety of aviation operations at LeRC is presented. Recommendations for improvements are provided whenever a significant impact on the present level of safety assurance is judged to be feasible, or an existing situation has the potential for creating a hazardous condition. E.A.K.

N86-13307# Department of the Navy, Washington, D. C.
PASSIVE ARM RETENTION CURTAIN Patent Application
T. J. Zenobi, inventor (to Navy) Filed 2 Nov. 1984 12 p
(AD-D011876; US-Patent-Appl-SN-667685) Avail: NTIS HC A02/MF A01 CSCL 01/3

A pilot arm retention system for an aircraft ejection seat which includes inertia reels and a parachute is comprised of a pair of nets connected between respective sides of the seat and a pair of deployment straps which are releasably coupled to the inertia reel straps and parachute risers and routed down over the front of the seat through a pair of snubbers to fixed points on the cockpit floor. Author (GRA)

N86-13308# Institut de Mecanique des Fluides de Lille (France).
AIRCRAFT CRASHING. ANALYSIS AND IDENTIFICATION METHODS. PRESENTATION OF A SOLUTION METHOD [CRASH D'AVIONS. METHODES D'ANALYSE ET D'IDENTIFICATION. PRESENTATION D'UNE METHODOLOGIE DE RESOLUTION]
P. Geoffroy and E. Haug (ESI SA) 19 Feb. 1985 102 p refs In FRENCH
(Contract DRET-83-452)
(IMFL-4116) Avail: NTIS HC A06/MF A01

An aircraft landing crash with a vertical velocity $>$ 5 m/sec is discussed. The tail section is assumed to make first contact. The nonlinear aspect of the problem is emphasized and a numerical solution is worked out. Superelements methods are found to be best suited to the problem. They conserve existing programs and finite element computations. An identification method is used to adjust the physical parameters in the superelements. The implementation of these techniques in the NL-CRASH program is proposed. Author (ESA)

N86-13617# Joint Publications Research Service, Arlington, Va.
CERTIFICATION GRANTED TO FRANCO-ITALIAN ATR 42
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 10-13 Repr. from Rev. Aerospatiale (France), Oct. 1985 p 10; 12 (For primary document see N86-13616 04-31) Avail: NTIS HC A03/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-13309# Aeronautical Research Labs., Melbourne (Australia).
AN ANALYTICAL COMPARISON OF THREE VISUAL APPROACH SLOPE INDICATORS: VASIS, T-VASIS AND PAPI
Jane Millar Aug. 1984 56 p refs Original contains color illustrations
(ARL/SYS-R-33; AR-003-963; SR-33) Avail: NTIS HC A04/MF A01

The three Visual Approach Slope Indicators (VASIs), VASIS, T-VASIS and PAPI, approved by the International Civil Aviation Organization (ICAO) for use by turbojet aeroplanes are compared. The discussion is based upon published performance data including approach path measurements and pilot opinion, ergonomics and the ability to fulfill operational requirements. It is concluded from flight trial data and operational experience that T-VASIS is a more precise and sensitive aid than Red-White VASIS which has several deficiencies. The current policy of not using Red-White VASIS for routine operations in Australia is supported by the conclusions. It is predicted that PAPI also will be less satisfactory than T-VASIS. This prediction is based mainly on ergonomic principles. Performance data about PAPI is limited and consists mainly of relatively uninformative pilot acceptance surveys. Because insufficient objective parameters describing trajectories of aircraft from the intended user-population have been published, most of the claims for PAPI superiority remain unsubstantiated. Accordingly, it is recommended that PAPI be evaluated using objective measures in a controlled experimental environment with transport aircraft.
Author

N86-13310*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
THE EVALUATION OF FAILURE DETECTION AND ISOLATION ALGORITHMS FOR RESTRUCTURABLE CONTROL Interim Report, Dec. 1983 - May 1984
P. Motyka, W. Bonnice, S. Hall, and E. Wagner Aug. 1984 207 p refs
(Contract NAS1-17556)
(NASA-CR-177983; NAS 1.26:177983; CSDL-R-1799) Avail: NTIS HC A10/MF A01 CSCL 01C

Three failure detection and identification techniques were compared to determine their usefulness in detecting and isolating failures in an aircraft flight control system; excluding sensor and flight control computer failures. The algorithms considered were the detection filter, the Generalized Likelihood Ratio test and the Orthogonal Series Generalized Likelihood Ratio test. A modification to the basic detection filter is also considered which uses secondary filtering of the residuals to produce unidirectional failure signals. The algorithms were evaluated by testing their ability to detect and isolate control surface failures in a nonlinear simulation of a C-130 aircraft. It was found that failures of some aircraft controls are difficult to distinguish because they have a similar effect on the dynamics of the vehicle. Quantitative measures for evaluating the distinguishability of failures are considered. A system monitoring strategy for implementing the failure detection and identification techniques was considered. This strategy identified the mix of direct measurement of failures versus the computation of failure necessary for implementation of the technology in an aircraft system.
Author

N86-13311*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DISCOVERY OF THE KALMAN FILTER AS A PRACTICAL TOOL FOR AEROSPACE AND INDUSTRY
Leonard A. McGee and Stanley F. Schmidt Nov. 1985 24 p refs
(NASA-TM-86847; Rept-85424; NAS 1.15:86847) Avail: NTIS HC A02/MF A01 CSCL 17G

The sequence of events which led the researchers at Ames Research Center to the early discovery of the Kalman filter shortly after its introduction into the literature is recounted. The scientific breakthroughs and reformulations that were necessary to transform Kalman's work into a useful tool for a specific aerospace application are described. The resulting extended Kalman filter, as it is now known, is often still referred to simply as the Kalman filter. As the filter's use gained in popularity in the scientific community, the problems of implementation on small spaceborne and airborne computers led to a square-root formulation of the filter to overcome numerical difficulties associated with computer word length. The work that led to this new formulation is also discussed, including the first airborne computer implementation and flight test. Since then the applications of the extended and square-root formulations of the Kalman filter have grown rapidly throughout the aerospace industry.
Author

N86-13312# National Airspace System Program Office, Washington, D.C.
NATIONAL AIRSPACE SYSTEM, SYSTEM REQUIREMENTS SPECIFICATION
21 Mar. 1985 209 p
(AD-A157944; NAS-SR-1000) Avail: NTIS HC A10/MF A01 CSCL 01/5

The NAS System Requirements Specification (NASSRS) is a compilation of requirements which describe the operational capabilities for the National Airspace System (NAS) as the NAS is envisioned to exist by the year 1995. In that context, it includes those existing and transitional capabilities that will also exist in the 1995 system. It is intended primarily for use as an internal FAA management tool to support the NAS design, engineering, and acquisition activities and to manage and control change to the NAS. The document provides a ground-based systems representation of the proposed operational capabilities planned for the NAS. As programs and subsystems are developed and implemented the capabilities they provide will be compared to this document as a measure of success of NAS Plan Implementation. The contents of the document include: overview; flight planning; traffic control and airspace management; monitoring; navigation; air defense and law enforcement surveillance; aircraft detection and identification; communications; maintenance and support: system effectiveness.
GRA

N86-13313# Eclectech Associates, Inc., North Stonington, Conn.
SHORT RANGE AIDS TO NAVIGATION SYSTEMS. DESIGN MANUAL FOR RESTRICTED WATERWAYS Final Draft Report
M. W. Smith, K. L. Marino, and J. Multer Jun. 1985 332 p
(Grant DOT-CG-835285-A)
(AD-A158213; EA-85-U-305; USCG-D-18-85) Avail: NTIS HC A15/MF A01 CSCL 17/7

This manual is intended to supplement the system design guidelines presented in Chapter 4 of the Aids to Navigation Manual - Administration (COMDTINST M16500.7). It provides procedures for designing or evaluating systems of aids in restricted waterways navigated by deep draft vessels. As such, it is an appropriate tool for use by the District Aids to Navigation Branch when conducting regularly scheduled waterways evaluations under the Waterways Analysis and Management System (WAMS) (COMDTINST M16500.11). Besides its structured approach to system design and evaluation, the manual provides a measure of quality for candidate aid configurations. This measure of quality is presented as an assessment of risk, providing the District or Headquarters analyst with an objective, quantifiable measure of effectiveness to support operational and budgetary decisions.
GRA

N86-13314# Army Construction Engineering Research Lab., Champaign, Ill.
DESIGN CRITERIA UPGRADE FOR US ARMY TYPE 2 AIR TRAFFIC CONTROL TOWERS Final Report
T. R. Napier, W. E. Back, and M. McCulley Jun. 1985 72 p

(AD-A159115; CERL-TR-P-85/13) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report documents research conducted to identify problem areas in; the design of existing Type 2 Air Traffic Control Tower (ATCT) installations and to develop standard design criteria to avoid these problems in future installations. Many design problem areas were identified in the ATCT structure's architectural design, substructure, superstructure, roof systems, exterior walls, interior construction, mechanical systems, electrical systems, and air traffic control interfaces. For each of these areas, specific solutions to the problems were recommended. However, incorporation of these solutions must consider a specific site location and environmental conditions. GRA

N86-13315# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TIME DELAY OF ARRIVAL LOCATION ASSESSMENT USING FOUR SATELLITES M.S. Thesis

C. M. Wozniakowski Dec. 1984 97 p

(AD-A159243; AFIT/GSO/PH/84D-5) Avail: NTIS HC A05/MF A01 CSCL 17/7

The Time of Arrival (TOA)/Time Delay of Arrival (TDOA) concepts for locating a source are reviewed. The Vela satellite program and how it was used in conjunction with the TOA concept is discussed. NAVSTAR/GPS is reviewed next and how this interrelates with the other concepts discussed is mentioned. The last concept mentioned is that of nuclear detection. Again, examples on how this idea interrelates with the previous mentioned concepts shown. The problem addressed here is to develop mathematical formulas that describe the problem of having four satellites viewing an event. The first method uses a TOA technique to solve the event's location and time. The second method employs the solution from the first method to predict uncertainty in location and time. Also this uncertainty is determined through the use of implicit differentiation. These results are then compared with the projected difference from the standard solution when the associated value is varied by an equivalent amount in the first method. Results from one example are discussed. Author (GRA)

N86-14165# Joint Publications Research Service, Arlington, Va.

DETERMINING QUASI-REAL-TIME LOCATION OF SHIPS USING GEOSTATIONARY NAVIGATIONAL SATELLITES

V. E. Abdullayev, K. Kh. Ismalilov, V. N. Vintayev, and G. A. Sosunov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 83-89 refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR: Ser. Fiz.-Tekhn. i Mat. Nauk (Baku), v. 6, no. 1, Jan. - Feb. 1985 p 96-101 (For primary document see N86-14111 04-88) Avail: NTIS HC A08

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-13316*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ABRASION BEHAVIOR OF ALUMINUM AND COMPOSITE SKIN COUPONS, STIFFENED SKINS AND STIFFENED PANELS REPRESENTATIVE OF TRANSPORT AIRPLANE STRUCTURES

Karen E. Jackson Nov. 1985 33 p refs

(DA Proj. 1L1-61102-AH-45)

(NASA-TP-2520; L-16018; NAS 1.60:2520; AVSCOM-TR-85-B-7) Avail: NTIS HC A03/MF A01 CSCL 01C

A three-phase investigation was conducted to compare the friction and wear response of aluminum and graphite-epoxy composite materials when subjected to loading conditions similar to those experienced by the skin panels on the underside of a transport airplane during an emergency belly landing on a runway surface. The first phase involved a laboratory test which used a standard belt sander to provide the sliding abrasive surface. Small skin-coupon test specimens were abraded over a range of pressures and velocities to determine the effects of these variables on the coefficient of friction and wear rate. The second phase involved abrading I-beam stiffened skins on actual runway surface over the same range of pressures and velocities used in the first phase. In the third phase, large stiffened panels which most closely resembled transport fuelage skin construction were abraded on a runway surface. This report presents results from each phase of the investigation and shows comparisons between the friction and wear behavior of the aluminum and graphite-epoxy composite materials. Author

N86-13317*# Operations Research, Inc., Rockville, Md.

TRADEOFF ANALYSIS OF TECHNOLOGY NEEDS FOR PUBLIC SERVICE HELICOPTERS

James S. Bauchspies, William R. Bryant, Jr., and William E. Simpson Aug. 1985 120 p refs

(Contract NASw-3554)

(NASA-CR-3927; NAS 1.26:3927; ORI-TR-2459) Avail: NTIS HC A06/MF A01 CSCL 01C

The design requirements for a family or type of Public Service Helicopter (PSH) is examined which will satisfy the needs of municipal and state governments in the following mission areas: Emergency Medical Service--Airborne Rescue Squad; Law Enforcement; Search and Rescue; and Environmental Control (Fire Fighting, Pollution, Resource Management). The report compares both design and performance requirements as specified by the PSH user's group against current technological capabilities, RTOPS and US Army LHX design requirements. The study explores various design trade-offs and options available to the aircraft designer/manufacturer in order to meet the several criteria specified by the PSH user's group. In addition, the report includes a brief assessment of the feasibility of employing certain advanced rotorcraft designs to meet the stringent combination of operational capabilities desired by the Public Service Helicopter Users. Author

N86-13318*# National Aeronautics and Space Administration, Washington, D. C.

AIRCRAFT OF THE FUTURE

S. Yeger (OKB Tupolev, USSR) Nov. 1985 9 p Transl. into ENGLISH from Techn.-Oekonomische Inform. der Zivilen Luftfahrt (West Germany), v. 13, no. 2, 1977 p 88-90 Original language document was announced in IAA as A77-39452 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.

(Contract NASw-4006)

(NASA-TM-77952; NAS 1.15:77952) Avail: NTIS HC A02/MF A01 CSCL 01C

Some basic problems connected with attempts to increase the size and capacity of transport aircraft are discussed. According to the square-cubic law, the increase in structural weight is proportional to the third power of the increase in the linear dimensions of the aircraft when geomettric similarity is maintained, while the surface area of the aircraft increases according to the second power. A consequence is that the fraction of useful weight will decrease as aircraft increase in size. However, in flying-wing designs in which the whole load on the wing is proportional to the distribution of lifting forces, the total bending moment on the wing will be sharply reduced, enabling lighter construction. Flying wings may have an ultimate capacity of 3000 passengers. DOE

N86-13319*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PRELIMINARY REPORT ON IN-FLIGHT MEASUREMENT OF ROTOR HUB DRAG AND LIFT USING THE RSRA

C. W. Acree, Jr. Oct. 1985 28 p refs

(NASA-TM-86764; Rept-85288; NAS 1.15:86764) Avail: NTIS HC A03/MF A01 CSCL 01C

The Rotor Systems Research Aircraft (RSRA) is a compound helicopter that was test flown as a fixed wing aircraft, with the main rotor blades removed and the rotor hub installed. An onboard rotor load measurement system measured the resulting rotor hub drag and lift. Measured hub drag and lift are plotted for comparison

to that predicted by full scale and 1/6 scale model wind tunnel tests. The success of the demonstration gives confidence that planned improvements to the RSRA will allow high accuracy hub drag and lift measurements to be made in flight on a routine research basis. Author

N86-13320*# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering/Computer Science.
INTERPRETATION OF F-106B IN-FLIGHT LIGHTNING SIGNATURES
T. F. Trost, M. G. Grothaus, and C. T. Wen Aug. 1985 51 p refs
(Grant NAG1-28)
(NASA-CR-176387; NAS 1.26:176387) Avail: NTIS HC A04/MF A01 CSCL 01C

Various characteristics of the electromagnetic data obtained on a NASA F-106B aircraft during direct lightning strikes are presented. Time scales of interest range from 10 ns to 400 microsecond. The following topics are discussed: (1) Lightning current, I, measured directly versus I obtained from computer integration of measured I-dot; (2) A method of compensation for the low frequency cutoff of the current transformer used to measure I; (3) Properties of fast pulses observed in the lightning time-derivative waveforms; (4) The characteristic D-dot signature of the F-106B aircraft; (5) An RC-discharge interpretation for some lightning waveforms; (6) A method for inferring the locations of lightning channel attachment points on the aircraft by using B-dot data; (7) Simple, approximate relationships between D-dot and I-dot and between B and I; and (8) Estimates of energy, charge, voltage, and resistance for a particular lightning event. Author

N86-13321*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROUND VIBRATION TEST OF THE LAMINAR FLOW CONTROL Jstar AIRPLANE
Michael W. Kehoe (NASA. Ames Research Center), F. W. Cazier, Jr. (NASA. Ames Research Center), and Joseph F. Ellison Oct. 1985 61 p
(NASA-TM-86398; L-15949; NAS 1.15:86398) Avail: NTIS HC A04/MF A01 CSCL 01C

A ground vibration test was conducted on a Lockheed JetStar airplane that had been modified for the purpose of conducting laminar flow control experiments. The test was performed prior to initial flight flutter tests. Both sine-dwell and single-point-random excitation methods were used. The data presented include frequency response functions and a comparison of mode frequencies and mode shapes from both methods. Author

N86-13322# Royal Aircraft Establishment, Farnborough (England).
STANDARDISED FATIGUE LOADING SEQUENCES FOR HELICOPTER ROTORS (HELIX AND FELIX). PART 2: FINAL DEFINITION OF HELIX AND FELIX
P. R. Edwards and J. Darts Aug. 1984 124 p
(AD-A156622; RAE-TR-84085; DRIC-BR-95846) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report defines two loading standards for the fatigue evaluation of helicopter rotor materials and components. They were developed as a collaborative study between West Germany, the Netherlands and UK. Details of the contributing organizations are given in Appendix A. The new loading standards follow the earlier TWIST (Transport Wing Standard), and FALSTAFF (Fighter Aircraft Loading Standard For Fatigue evaluation). After the tradition of these earlier loading sequences, the new loading standards have been given identifying names. For these the origin of the word helicopter (Helix-spiral, pteronwing from the Greek) has provided a convenient basis. The new standards are called: Helix loading standard for hinged or articulated rotors; Felix loading standard for fixed or semi-rigid rotors. This report defines the final form of the two standards, statistical content according to different counting methods and full details of their method of generation. GRA

N86-13323# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
LIMITED AIRWORTHINESS AND FLIGHT CHARACTERISTICS (A AND FC) TEST OF THE QUICK FIX CONFIGURATION Final Report, 23 May - 27 Jun. 1984
G. L. Skinner, G. M. Bishop, E. J. Tavares, and R. C. Murrell Oct. 1984 67 p
(AD-A157716; USAAEFA-83-20) Avail: NTIS HC A04/MF A01 CSCL 01/3

The US Army Aviation Engineering Flight Activity conducted an evaluation to determine the increase in power required and the change in handling qualities due to the installation of the AN/ALQ-151(V)2 countermeasures system and associated mission equipment on the UH-60A helicopter. Testing conducted between 23 May to 2 June 1984 totaled 12.4 hours. The addition of the Quick Fix System and associated mission equipment created an increase in equivalent flat plate area (F sub e) of 17 sq ft (ft2) for advance ratios (mu) of 0.26 and greater. For mu's less than 0.26, the change in F sub e increased above 17 sq ft as a function of thrust coefficient. Handling qualities of the Quick Fix configured YEH-60A were unchanged from a normal utility configured UH-60A and were determined satisfactory. One deficiency, interference between the main rotor blades and the upper elements of the (no. 3 and no. 4) direction finding dipole antennas during ground taxi and four shortcomings were associated with the Quick Fix configuration. GRA

N86-13324# SRI International Corp., Menlo Park, Calif.
PHYSICAL DISTRIBUTION SYSTEM FOR AIRCRAFT EXTERNAL FUEL TANKS-SURVEY Final Report, 1 Mar. - 31 May 1985
G. B. Andeen, R. D. Kornbluh, T. P. Low, R. H. Monahan, and W. Park Jun. 1985 96 p
(Contract N00600-82-D-8362)
(AD-A158275; DTNSRDC/CMLD-CR-47-85) Avail: NTIS HC A05/MF A01 CSCL 13/4

The general objective of this study was to conduct a survey and analysis of current and planned aircraft external fuel tanks, with emphasis on the disposability and nestability aspects of these fuel tanks. The study focused on design requirements, fabrication and assembly, and physical distribution, with particular attention directed to the use of the robotic equipment for the assembly of nestable fuel tanks aboard the ship. The principal conclusion of this study is that the development of disposable, nestable external aircraft fuel tanks with automated assembly aboard ship, using robotic equipment, is a feasible option for implementation within the next five to ten years. Chapter 1 of the report presents an introduction and summary description of the major results of the survey. Chapter 2 then provides a summary description of the tentative operational requirements established by the Navy for disposable, nestable external aircraft fuel tanks. Chapter 3 presents a discussion of the possible fabrication and assembly techniques and problems for such fuel tanks. Chapter 4 then discusses the physical distribution aspects of external aircraft fuel tanks. Chapter 5 concludes with a listing of the conclusions and recommendations resulting from this analysis. GRA

N86-13325# Hughes Helicopters, Culver City, Calif.
ADVANCED TECHNOLOGY HELICOPTER LANDING GEAR PRELIMINARY DESIGN INVESTIGATION Final Report, Sep. 1983 - Jul. 1984
J. K. Sen, M. W. Votaw, and D. C. Weber Jul. 1985 247 p
(Contract DAAK51-83-C-0039; DA Proj. 1L1-62209-AH-76)
(AD-A158816; HHI-84-284; USAAVSCOM-TR-84-D-20) Avail: NTIS HC A11/MF A01 CSCL 01/3

This report describes the preliminary designs of two configurations of helicopter crashworthy landing gears: (1) with the trailing arms of the main gear coupled with a torque, which forces both shock struts to absorb the kinetic energy of an unsymmetrical crash impact, and (2) with the trailing arms uncoupled; i.e., the torque tube is replaced by a cross tube which is incapable of reacting the high torsional load of an unsymmetrical crash impact. Retractable and fixed landing gears of both configurations have been designed, as well as a standard (noncrashworthy) retractable landing gear. All landing gears are of tailwheel designs. The designs apply the systems approach to crashworthiness where the total

impact energy absorbed is shared by the landing gear, fuselage and seat. The designs of the crashworthy landing gears were completed after a preliminary investigation of crash impact at sink speeds up to 42 fps, roll angles up to + or - 20 degrees and pitch angles up to -10+20 degrees. The crashworthy evaluations were made with program KRASH. A detailed analysis with KRASH was then conducted for all configurations of landing gears. Based on the weight trend curves and cost analysis, a crashworthy design criterion was recommended. This design criterion was the basis for updating the landing gear design. The designs identify the fabrication methods and processes for the landing gear. Estimates of cost and weight of the updated designs are also presented. GRA

N86-13326# Sikorsky Aircraft, Stratford, Conn.
TRANSMISSION ACOUSTIC VIBRATION TESTING Final Report, Sep. 1982 - Nov. 1983
C. Yoerkie and A. Chory Jul. 1985 85 p
(Contract DAAK51-82-C-0040; DA Proj. 1L2-63201-DB-72)
(AD-A159022; USAAVRADCOM-TR-83-D-34) Avail: NTIS HC A05/MF A01 CSCL 01/3

Laboratory tests were conducted to determine the individual and combined effects of a high contact ratio (HCR) planetary gearset and a stainless steel housing on the acoustic (high frequency) vibration signature of the BLACK HAWK helicopter main transmission. Vibration levels at the planetary mesh frequency increased significantly with the stainless steel housing, but increased unexpectedly with the HCR planetary. The primary reason for the increased response with the HCR was the reduced gear face widths. GRA

N86-13327# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AIRCREW DOSE AND ENGINE DUST INGESTION FROM NUCLEAR CLOUD PENETRATION M.S. Thesis
S. P. Conners Mar. 1985 168 p
(AD-A159246; AFIT/GNE/PH/85M-4) Avail: NTIS HC A08/MF A01 CSCL 01/2

This thesis evaluates the threat to aircraft and aircrew from dust and radioactivity in a cloud generated by nuclear surface bursts. A model of the nuclear cloud is generated, using any number and type of weapons and any desire dust size distribution. The cloud is propagated through the atmosphere for a given time, then penetrated by an aircraft. The activity density in the cloud is converted to dose to the crew for a given path through the cloud. Radiation shielding and dust filters are included in the calculations. Alternatively, the cloud dust mass density can be converted to mass trapped in a filter or the cabin, or to the dust mass that has entered the engine. Methods for determining particle size and altitude distributions are presented. The ionizing dose to the crewmember is computed for both sky-shine and the dust trapped in the cabin during cloud passage. A method of computing the shielding power of the crew compartment against sky-shine is presented. Given the air flow rate into a filter or engine, the mass of ingested dust is found. These nuclear cloud and aircraft models are incorporated in a computer code oriented toward operational use. A significant feature of the code includes the ability to easily change the scenario with menu driven options. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-13328*# Teledyne Continental Motors, Muskegon, Mich.
LIGHTWEIGHT TWO-STROKE CYCLE AIRCRAFT DIESEL ENGINE TECHNOLOGY ENABLEMENT PROGRAM, VOLUME 1 Final Report, Dec. 1979 - Aug. 1985
P. D. Freen, S. G. Berenyi, A. P. Brouwers, and M. E. Moynihan Aug. 1985 116 p
(Contract NAS3-22218)
(NASA-CR-174923-Vol-1; NAS 1.26:174923-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21G

An experimental Single Cylinder Test Engine Program is conducted to confirm the analytically projected performance of a two-stroke cycle diesel engine for aircraft applications. The test engine delivered 78kW indicated power from 1007cc displacement, operating at 3500 RPM on Schnuerle loop scavenged two-stroke cycle. Testing confirms the ability of a proposed 4-cylinder version of such an engine to reach the target power at altitude, in a highly turbocharged configuration. The experimental program defines all necessary parameters to permit design of a multicylinder engine for eventual flight applications; including injection system requirement, turbocharging, heat rejection, breathing, scavenging, and structural requirements. The multicylinder engine concept is configured to operate with an augmented turbocharger, but with no primary scavenge blower. The test program is oriented to provide a balanced turbocharger compressor to turbine power balance without an auxiliary scavenging system. Engine cylinder heat rejection to the ambient air has been significantly reduced and the minimum overall turbocharger efficiency required is within the range of commercially available turbochargers. Analytical studies and finite element modeling is made of insulated configurations of the engines - including both ceramic and metallic versions. A second generation test engine is designed based on current test results. Author

N86-13329*# Teledyne Continental Motors, Muskegon, Mich.
LIGHTWEIGHT TWO-STROKE CYCLE AIRCRAFT DIESEL ENGINE TECHNOLOGY ENABLEMENT PROGRAM, VOLUME 2 Final Report, Dec. 1979 - Aug. 1985
P. D. Freen, S. G. Berenyi, A. P. Brouwers, and M. E. Moynihan Aug. 1985 150 p refs
(Contract NAS3-22218)
(NASA-CR-174923-Vol-2; NAS 1.26:174923-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 21G

An experimental Single Cylinder Test Engine Program is conducted to confirm the analytically projected performance of a two-stroke cycle diesel engine for aircraft applications. Testing confirms the ability of a proposed 4-cylinder version of such an engine to reach the target power at altitude in a highly turbocharged configuration. The experimental program defines all necessary parameters to permit a design of a multicylinder engine for eventual flight applications. Author

N86-13330*# Teledyne Continental Motors, Muskegon, Mich.
LIGHTWEIGHT TWO-STROKE CYCLE AIRCRAFT DIESEL ENGINE TECHNOLOGY ENABLEMENT PROGRAM, VOLUME 3 Final Report, Dec. 1979 - Aug. 1985
P. D. Freen, S. G. Berenyi, A. P. Brouwers, and M. E. Moynihan Aug. 1985 282 p
(Contract NAS3-22218)
(NASA-CR-174923-Vol-3; NAS 1.26:174923-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 21G

An experimental Single Cylinder Test Engine Program is conducted to confirm the analytically projected performance of a

two-stroke cycle diesel engine for aircraft applications. Testing confirms the ability of a proposed 4-cylinder version of such an engine to reach the target power at altitude in a highly turbocharged configuration. The experimental program defines all necessary parameters to permit design of a multicylinder engine for eventual flight applications. Author

N86-13331# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
HUB EFFECTS IN PROPELLER DESIGN AND ANALYSIS
M. H. Wang Jul. 1985 183 p
(Contract N00014-82-K-0198)
(AD-A158853; OE-85-14) Avail: NTIS HC A09/MF A01 CSCL 20/4

A numerical model is established for the design of propeller blade shape for a prescribed circulation and a given hub geometry. The vortex lattice approach is adapted for blades and their wakes. The hub is represented by a distribution of dipoles which ends at the hub apex. It is shown that consideration of the hub results in a lower pitch and lower camber at the inner radii. An iterative method is developed for analyzing the interference between the blades and the hub. It is shown that the circulation at the root of a propeller with a hub is larger than the circulation at the root of a propeller without a hub. Two examples show that the increase in thrust due to hub effects has the same order of magnitude as the drag force effects on the hub for propellers which are moderately loaded at the hub. Experiments are carried out for comparison with the numerical results. Excellent agreement is obtained in the circulation distribution for a conventional propeller, and fair agreement for a controllable pitch propeller. Experimental results show what the circulation is, roughly speaking, conserved. A method for estimating the drag force of the hub due to the hub vortex is established by assuming that the circulation is conserved. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-13332*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PRELIMINARY EVALUATION OF THE GENERALIZED LIKELIHOOD RATIO FOR DETECTING AND IDENTIFYING CONTROL ELEMENT FAILURES IN A TRANSPORT AIRCRAFT
W. Thomas Bundick Sep. 1985 94 p refs
(NASA-TM-87620; NAS 1.15:87620) Avail: NTIS HC A05/MF A01 CSCL 01C

The application of the Generalized Likelihood Ratio technique to the detection and identification of aircraft control element failures has been evaluated in a linear digital simulation of the longitudinal dynamics of a B-737 aircraft. Simulation results show that the technique has potential but that the effects of wind turbulence and Kalman filter model errors are problems which must be overcome. Author

N86-13333*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FIT: COMPUTER PROGRAM THAT INTERACTIVELY DETERMINES POLYNOMIAL EQUATIONS FOR DATA WHICH ARE A FUNCTION OF TWO INDEPENDENT VARIABLES
P. Douglas Arbuckle, Steven M. Sliwa, Marie-Louise Roy, and Sherwood H. Tiffany (PRC Kentron, Inc., Hampton, Va.) Oct. 1985 20 p refs
(NASA-TM-86413; L-15983; NAS 1.15:86413) Avail: NTIS HC A02/MF A01 CSCL 01C

A computer program for interactively developing least-squares polynomial equations to fit user-supplied data is described. The program is characterized by the ability to compute the polynomial equations of a surface fit through data that are a function of two independent variables. The program utilizes the Langley Research Center graphics packages to display polynomial equation curves and data points, facilitating a qualitative evaluation of the effectiveness of the fit. An explanation of the fundamental principles and features of the program, as well as sample input and corresponding output, are included. Author

N86-13334# Air Force Academy, Colo.
PITCH RATE VERSUS G COMMAND AS THE LONGITUDINAL FLIGHT CONTROL SYSTEM DESIGN STRATEGY FOR A STATISTICALLY UNSTABLE FIGHTER TYPE AIRCRAFT WITH TWO CONTROL SURFACES
T. P. Webb 2 Jul. 1985 32 p
(AD-A158803; USAFA-TN-85-8) Avail: NTIS HC A03/MF A01 CSCL 01/4

Pitch rate command and normal G command longitudinal flight control systems were designed using linear optimal control theory for a statically unstable, two control surface, fighter-type aircraft at both a power approach and an up-and-away flight condition. The closed-loop systems were then evaluated in man-in-the-loop simulations with pilots attempting random altitude tracking and pitch tracking tasks. The evaluation results indicated that in the power approach flight condition, normal G command was more suitable for altitude tracking and pitch rate command was preferred for pitch tracking. Results for the up-and-away flight condition were inconclusive. GRA

N86-13335# Southwest Research Inst., San Antonio, Tex.
DIGITAL SERVOCONTROLLER SYSTEM. VOLUME 4. RESULTS AND CONCLUSIONS Final Report, Jul. 1983 - Nov. 1984
J. Lopez and K. Miller Feb. 1985 31 p
(AD-A159068; SWRI-14-7676-Vol-4; AFWAL-TR-84-3117-Vol-4)
Avail: NTIS HC A03/MF A01 CSCL 09/2

This final report describes an exploratory development effort for the design and fabrication of a digital servocontroller system for load control in full-scale air-frame fatigue tests. Each digital controller replaces four analog controllers. The LSI-11/23 microcomputer in the digital controller executes a PI algorithm to implement direct digital control. It may operate in a stand-alone mode or as a slave processor to a master computer via fiber optic link. Other programmable features specify loop parameters, building load profiles, adjusting control system gains and monitoring alarm and abort conditions. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-13336# Aeronautical Research Labs., Melbourne (Australia).
A REAL-TIME DATA ACQUISITION SYSTEM FOR A LOW SPEED WIND TUNNEL
B. D. Fairlie Feb. 1985 36 p
(AR-AERO-R-163; AR-003-997; AR-163) Avail: NTIS HC A03/MF A01

A mini-computer based real time data acquisition system designed for use in the Aeronautical Research Laboratories low speed wind tunnel is presented. An overview of the logical arrangement of the software components of the system is provided and their interaction with the mini-computer operating system, data structures, and system hardware is described. Author

N86-13337# Aeronautical Research Labs., Melbourne (Australia).
ALGORITHMS FOR THE REDUCTION OF WIND-TUNNEL DATA DERIVED FROM STRAIN GAUGE FORCE BALANCES
B. D. Fairlie 1985 49 p refs

(ARL/AERO-R-164; AR-004-017) Avail: NTIS HC A03/MF A01

Algorithms and procedures are presented for the reduction of force and moment data derived from wind-tunnel models supported by internal strain-gauge balances. The algorithms are developed in their most general forms, suitable for implementation on the new generation of powerful minicomputers currently being included in wind-tunnel data acquisition systems. Although the emphasis is on the treatment of data derived from sting mounted strain gauge force balances, the analysis is applicable, with only minor modifications, to data derived from modern load-cell based external force balances. Author

N86-13338*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPUTER PROGRAM FOR CALCULATING FLOW PARAMETERS AND POWER REQUIREMENTS FOR CRYOGENIC WIND TUNNELS

David A. Dress Nov. 1985 41 p refs

(NASA-TM-87609; L-16024; NAS 1.15:87609) Avail: NTIS HC A03/MF A01 CSCL 14B

A computer program has been written that performs the flow parameter calculations for cryogenic wind tunnels which use nitrogen as a test gas. The flow parameters calculated include static pressure, static temperature, compressibility factor, ratio of specific heats, dynamic viscosity, total and static density, velocity, dynamic pressure, mass-flow rate, and Reynolds number. Simplifying assumptions have been made so that the calculations of Reynolds number, as well as the other flow parameters can be made on relatively small desktop digital computers. The program, which also includes various power calculations, has been developed to the point where it has become a very useful tool for the users and possible future designers of fan-driven continuous-flow cryogenic wind tunnels. Author

N86-13339# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.

A DURABLE AIRFIELD MARKING SYSTEM Final Report, 23 Jun. 1980 - 30 Sep. 1984

T. Novinson Jun. 1985 52 p

(AF Proj. 2054)

(AD-A157953; AFESC/ESL-TR-84-59) Avail: NTIS HC A04/MF A01 CSCL 01/5

This report describes a 4-year work unit on the selection, development, and testing of a novel airfield marking system on ceramic-coated aluminized steel (CAS) tiles. The CAS tiles were developed to replace painted center marking lines that are obliterated by rubber streaks from jet tires from landing aircraft. The tiles are recessed or set into the pavement by grinding out 50- by 30-foot sections (1/8 inch deep) and bonding the tiles with epoxy/polyamide adhesive (2,000- to 5,000-psi tensile strength). The tiles can be easily cleaned by spraying with aqueous detergent and wiping off the rubber residue. The tiles are flexible, weather-resistant, chemically resistant, and highly reflective in day or evening, without retroreflective glass spheres. At $2.00 to $5.00 sq. ft., the CAS tiles are much more expensive than Federal Specification TT-P-1952 latex paint (about $0.10 sq. ft.), but the high initial cost can be offset in 1 year by lower maintenance costs. Although these CAS tiles are still being tested for Air Force use, the life cycle might be 5 to 10 years before replacement. GRA

N86-13340# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

INVESTIGATION FOR THE DEFINITION OF A HYDRAULIC MULTIDEGREE OF FREEDOM VIBRATION FACILITY Final Report

Hahn Reisch Paris ESA 28 Feb. 1985 108 p refs

(Contract ESTEC-5179/82/NL-PL(SC); IABG-342-7027-01/02)

(B-TF-1627; ESA-CR(P)-1950) Avail: NTIS HC A06/MF A01

A six degree-of-freedom vibration test facility for spacecraft structures is proposed. Upper frequency limit is 100 Hz. The main design criteria are: welded steel table with flat surface; mondifferential hydraulic actuators with hydrostatic piston rod bearing, 4 in vertical direction, 4 in horizontal direction; 3 three-stage servovalves in parallel; hydraulic power supply with additional oil accumulators; seismic foundation; automatic control based on analog circuits and coordinated control of the multiple actuator system with respect to the test table; multiaxial safety system; and a control and measurement system based on a 32-bit computer with array-processor. Author (ESA)

N86-13341# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

TEST OF THE ONERA CRYOGENIC BALANCE IN THE T2 WIND TUNNEL Final Report [ESSAI DE LA BALANCE CRYOGENIC ONERA DANS LA SOUFFLERIE T2 DU CFRT]

M. Bazin Feb. 1985 26 p refs In FRENCH

(Contract DRET-83-34-135)

(ONERA-BT-8/0791-GY) Avail: NTIS HC A03/MF A01

Balance qualification tests in the T2 wind tunnel are described. The feasibility of force measurement in cryogenic conditions was studied. The tests confirm accurate functioning in the temperature range 100 to 300K, showing a good compensation of electrical and mechanical temperature effects. The observed thermal gradients do not influence the required precision of one per thousand of the balance capacity. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-13342*# Eagle Engineering, Inc., Houston, Tex.

PLANETARY SAMPLE RAPID RECOVERY AND HANDLING Final Report

20 Sep. 1985 98 p

(Contract NAS9-17176)

(NASA-CR-171906; NAS 1.26:171906; Rept-85-105) Avail: NTIS HC A05/MF A01 CSCL 22A

Methods for recovering and cost effectively handling planetary samples following return to the vicinity of Earth were designed for planetary mission planners. Three topics are addressed: (1) a rough cost estimate was produced for each of a series of options for the handling of planetary samples following their return to the vicinity of Earth; (2) the difficulty of quickly retrieving planetary samples from low circular and high elliptical Earth orbit is assessed; and (3) a conceptual design for a biological isolation and thermal control system for the returned sample and spacecraft is developed. E.A.K.

N86-13343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS

Norman J. Schofield, Jr., Ronald G. Littlefield, and Mary F. Elsen Feb. 1985 337 p

(NASA-TM-87499; NSSDC/WDC-A-R/S-85-01; NAS 1.15:87499) Avail: NTIS HC A15/MF A01 CSCL 22A

This report provides the professional community with information on current and planned spacecraft activity (including both free-flying spacecraft and Shuttle-attached payloads) for a broad range of scientific disciplines. By providing a brief description of each spacecraft and experiment as well as its current status, it is hoped that this document will be useful to many people interested in the scientific, applied, and operational uses of the data collected. Furthermore, for those investigators who are planning or coordinating future observational programs employing a number of different techniques such as rockets, balloons, aircraft, ships, and buoys, this document can provide some insight into the contributions that may be provided by orbiting instruments. The document includes information concerning active and planned spacecraft and experiments. The information covers a wide range of scientific disciplines: astronomy, earth sciences, meteorology, planetary sciences, aeronomy, particles and fields, solar physics, life sciences, and material sciences. These spacecraft projects represent the efforts

and funding of individual countries, as well as cooperative arrangements among different countries. Author

N86-13344# European Space Agency, Paris (France).
REPORT ON THE SCIENTIFIC SATELLITES OF THE EUROPEAN SPACE AGENCY
K. Bennett, V. Domingo, U. O. Frisk, R. Grard, P. Jakobsen, M. Kessler, K. Knott, J.-P. Lebreton, R. G. Marsden, D. E. Page et al May 1985 105 p
(ESA-SP-1072) Avail: NTIS HC A06/MF A01

The activities of the Cos-B, GEOS, ISEE, IUE, and Exosat satellites, and the First Spacelab Payload are summarized. The status of the Giotto, Ulysses (International Solar Polar Mission), Space Telescope, Hipparcos, and EURECA projects is outlined. The SOHO, cluster (cosmic plasma), Kepler (Mars orbiter), Cassini (Saturn orbiter and Titan probe), AGORA (asteroid rendezvous and flyby), X-ray Multimirror Astronomy Mission, Far Infrared and Submillimeter Space Telescope, Lyman (UV astronomy), and QUASAT (VLBI) studies are introduced. Author (ESA)

N86-14197# Joint Publications Research Service, Arlington, Va.
COMMENTS ON ANNIVERSARY OF APOLLO-SOYUZ FLIGHT
Ya. Golovanov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 133-139 Transl. into ENGLISH from Komsomolskaya Pravda (Moscow), 14 Jul. 1985 p 3-4 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14198# Joint Publications Research Service, Arlington, Va.
SOVIET-FRENCH COMMISSION DISCUSSES JOINT SPACE PROJECTS Abstract Only
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 140 Transl. into ENGLISH from NTR: Probl. i Resheniya (Moscow), no. 1, 28 May - 10 Jun. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N86-13345*# Smithsonian Institution, Cambridge, Mass.
ANALYTICAL INVESTIGATION OF THE DYNAMICS OF TETHERED CONSTELLATIONS IN EARTH ORBIT, PHASE 2 Quarterly Report, 22 Feb. - 21 Jun. 1985
Enrico Lorenzini Jul. 1985 31 p
(Contract NAS8-36606)
(NASA-CR-171611; NAS 1.26:171611; QR-1) Avail: NTIS HC A03/MF A01 CSCL 22C

This Quarterly Report deals with the deployment maneuver of a single-axis, vertical constellation with three masses. A new, easy to handle, computer code that simulates the two-dimensional dynamics of the constellation has been implemented. This computer code is used for designing control laws for the deployment maneuver that minimizes the acceleration level of the low-g platform during the maneuver. Author

N86-13346# Ricerche e Progetti s.r.l., Turin (Italy).
CROWDING OF THE GEOSTATIONARY ORBIT Final Report
Giorgio Fusco and Alessandro Buratti Paris ESA Oct. 1984 162 p refs
(Contract ESA-5705/83/NL-PP(SC))
(ESA-CR(P)-2050) Avail: NTIS HC A08/MF A01

The number of likely collisions and disturbances suffered by an active geostationary satellite involving abandoned geosynchronous satellites and other active satellites in the same longitudinal slot is evaluated. While the risk of a collision with (and even of disturbances from) abandoned satellites is very remote, the risk of a collision and the number of likely disturbances during the lifetime of a satellite with other satellites operating in the same longitudinal slot could be unacceptably high, its value depending on stationkeeping strategies which, in turn, depend on mission constraints and satellite design. Provisions involving spacecraft and ground station equipment to reduce collision and disturbance risks are discussed. Algorithms to build a detailed model of the population of abandoned objects around the geostationary orbit are presented. Author (ESA)

N86-14130# Joint Publications Research Service, Arlington, Va.
A PRIORI GUARANTEED ACCURACY EVALUATION IN DETERMINING SPACECRAFT ORBIT BY LEAST SQUARES METHOD Abstract Only
P. Ye. Elyasberg *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 38-39 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 643-650 Previously announced in IAA as A85-15251 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N86-13347# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AEROTHERMODYNAMICS FOR FUTURE LAUNCHERS. REVIEW OF THE STATE OF THE ART IN EUROPE Final Report
J. F. Wendt and J. A. Essers Paris ESA Mar. 1984 131 p refs
(Contract ESA-5477/83/F-FC(SC))
(VKI-CR-1984-16/AR; ESA-CR(P)-2037) Avail: NTIS HC A07/MF A01

The status of wind tunnel and computational expertise in hypersonic aerothermodynamics, and areas of concern for a reuseable first stage vehicle and a reuseable second stage vehicle were reviewed. Many potentially useful facilities exist but require modernization. Insufficient large-scale facilities are available at M > 5 to permit development tests. Considerable basic computational expertise exists, but techniques for complex geometries and access to very large computers remain problems. The reactivation of 3 existing facilities and the modernization of up to 10 existing facilities is suggested, as well as the examination of 3 new special purpose research facilities. Contact should be with the U.S. authorities for final tests in very large tunnels. A European computer center should be established to efficiently provide essential services to users, in the research and in the design phases. A research program should be initiated to provide the necessary base. Author (ESA)

N86-14095*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
FLUORINE DISPOSAL
Allen Rakow *In its* The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 23 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-13348# RAND Corp., Santa Monica, Calif.
IMPROVING MILSATCOM (MILITARY SATELLITE COMMUNICA-

TION) ACQUISITION OUTCOMES: LEASE VERSUS BUY
P. M. Dinneen and T. H. Quinn Jan. 1985 46 p
(Contract F49620-82-C-0018)
(AD-A158842; RAND/N-2209-AF) Avail: NTIS HC A03/MF A01 CSCL 15/5

This study was requested by the Director of Space Systems and Command, Control, and Communications, Office of the Deputy Chief of Staff (Research, Development, and Acquisition), Headquarters United States Air Force, to assist in improving the outcomes of military satellite communication (MILSATCOM) programs. In view of rapidly rising costs of military space systems, leasing has been suggested as one way of controlling these costs. The purpose of this study, therefore, was to identify and analyze the central considerations relevant to determining whether to lease or by MILSATCOM services. The results of this report should be of interest to members of MILSATCOM acquisition community and others concerned with making lease versus buy decisions in the public sector. The work was conducted under the MILSATCOM Acquisition Policy project of the Project Air Force Resource Management Program. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N86-13349*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURES AND MATERIALS TECHNOLOGY ISSUES FOR REUSABLE LAUNCH VEHICLES
S. C. Dixon, Darrel R. Tenney, Donald R. Rummler, Allan R. Wieting, and R. M. Bader (AFWAL, Dayton, Ohio) Oct. 1985 30 p refs Presented at the EASCON 85 18th Ann. Electron. and Aerospace Systems Conf., Washington, D.C., 28-30 Oct. 1985
(NASA-TM-87626; NAS 1.15:87626) Avail: NTIS HC A03/MF A01 CSCL 22B

Projected space missions for both civil and defense needs require significant improvements in structures and materials technology for reusable launch vehicles: reductions in structural weight compared to the Space Shuttle Orbiter of up to 25% or more, a possible factor of 5 or more increase in mission life, increases in maximum use temperature of the external surface, reusable containment of cryogenic hydrogen and oxygen, significant reductions in operational costs, and possibly less lead time between technology readiness and initial operational capability. In addition, there is increasing interest in hypersonic airbreathing propulsion for launch and transmospheric vehicles, and such systems require regeneratively cooled structure. The technology issues are addressed, giving brief assessments of the state-of-the-art and proposed activities to meet the technology requirements in a timely manner. Author

N86-13350# MATRA Espace, Toulouse (France).
REVIEW OF IMPLICATIONS AND USEFULNESS OF SPACECRAFT SERVICING IN LOW EARTH ORBIT (LEO) Final Report
C. Cougnet, G. Berger, Ph. LeBouar, L. Kerstein (MBB, Ottobrunn, West Germany), H. Wartenberg (MBB, Ottobrunn, West Germany), M. Spies (MBB, Ottobrunn, West Germany), Widjaja (SENER), and J. DelToro Paris ESA 22 Oct. 1984 709 p refs
(Contract ESA-5610/83/NL)
(MATRA-092/CC/AB/225-84; ESA-CR(P)-2013) Avail: NTIS HC A99/MF A01

The usefulness, technical and operational implications, and cost effectiveness of the orbital servicing of a spacecraft performed on-board the Space Station, with a direct involvement of man, and automatically in spacecraft orbit with a servicer vehicle were investigated. Mission analysis; and identification and analysis of servicing functions and operations, and of the impacts of servicing requirements on spacecraft design are outlined. Design evolution of a EURECA type platform is discussed. A philosophy and definition of elements required by the servicing functions on board the space station are established. Servicing elements for automatic orbital servicing are defined. Orbital servicing supporting technologies are reviewed. Economic aspects of a platform mission performed with and without orbital servicing are compared. Author (ESA)

N86-13351# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Systems Studies and Applications.
IN-ORBIT TECHNOLOGY DEMONSTRATION PROGRAM (TDP). ACCOMMODATION STUDY: SPAS
Paris ESA Aug. 1984 507 p
(Contract ESTEC-5711/83/NL-PR)
(MBB-URV-147/84; ESA-CR(P)-2036) Avail: NTIS HC A22/MF A01

An accommodation study for an in-orbit technology demonstration program (TDP) was conducted for a Shuttle Pallet Satellite (SPAS) emphasizing reuse of the existing SPAS-01, which could be employed in an attached Shuttle sortie mode (SPAS-B1) and a short detached mode (SPAS-B1/F). Modifications of SPAS-01 as a short-time free-flying Shuttle subsatellite (SPAS-B2) or as short-time free-flying reusable TDP-experiment carrier (SPAS-B3) were studied. Eight Core Model Payloads (CMP) were identified and the feasibility of accomodation on the SPAS-candidates assessed. For SPAS-B1, 3 CMP with 13 to 16 experiments each were derived for TDP-missions starting in 1986/87. The critical procurement path is the availability of the TDP-experiments in time. The study suggests that from the existing SPAS-01, very promising SPAS-candidate carriers (attached or free-flying type) can be implemented in the TDP-program. The features of SPAS are its flexible program mission application, its versatile adaptions of different payloads and payload types, and its cost beneficial and economic procurement approach options. Author (ESA)

N86-13352# European Space Agency, Paris (France).
EURECA: AN INTRODUCTION TO EUROPE'S FREE-FLYING RETRIEVABLE CARRIER
N. Longdon, comp. May 1985 21 p refs Original contains color illustrations
(ESA-BR-30; ISSN-0250-1589) Avail: NTIS HC A02/MF A01

The European Retrievable Carrier (EURECA) is a reusable platform launched by the Shuttle, released in a free flying mode for 6 months or more, and then retrieved by the Shuttle Orbiter and returned to Earth. Payload capacity is up to 1000 kg. The first EURECA payload is primarily dedicated to material and life sciences which benefit from the microgravity environment. The versatility of the system is demonstrated by the fact that a quarter of the payload weight is taken up by space science and technological experiments. The EURECA provides an excellent test bed to demonstrate in-flight technologies such as direct data relay from low Earth orbits via geostationary satellites to a central operations center, rendezvous and docking, and in-orbit servicing. Earth observation possibilities, and commercial applications (new materials, crystal growth, proteins, and pharmaceutical products) are numerous. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N86-13353*# GMD Systems, Lancaster, Calif.
MATHEMATICAL ANALYSIS STUDY FOR RADAR DATA PROCESSING AND ENHANCEMENT. PART 1: RADAR DATA ANALYSIS Final Report
Robert James and James D. Brownlow Aug. 1985 384 p refs

2 Vol.
(Contract NAS2-11491)
(NASA-CR-166616-Pt-1; H-1287-Pt-1; NAS 1.26:166616-Pt-1)
Avail: NTIS HC A17/MF A01 CSCL 17B

A study is performed under NASA contract to evaluate data from an AN/FPS-16 radar installed for support of flight programs at Dryden Flight Research Facility of NASA Ames Research Center. The purpose of this study is to provide information necessary for improving post-flight data reduction and knowledge of accuracy of derived radar quantities. Tracking data from six flights are analyzed. Noise and bias errors in raw tracking data are determined for each of the flights. A discussion of an altiude bias error during all of the tracking missions is included. This bias error is defined by utilizing pressure altitude measurements made during survey flights. Four separate filtering methods, representative of the most widely used optimal estimation techniques for enhancement of radar tracking data, are analyzed for suitability in processing both real-time and post-mission data. Additional information regarding the radar and its measurements, including typical noise and bias errors in the range and angle measurements, is also presented. This is in two parts. This is part 1, an analysis of radar data.
Author

N86-13354*# GMD Systems, Lancaster, Calif.
MATHEMATICAL ANALYSIS STUDY FOR RADAR DATA PROCESSING AND ENCHANCEMENT. PART 2: MODELING OF PROPAGATION PATH ERRORS Final Report
Robert James and James D. Brownlow Aug. 1985 124 p refs 2 Vol.
(Contract NAS2-11491)
(NASA-CR-166616-Pt-2; H-1287-Pt-2; NAS 1.26:166616-Pt-2)
Avail: NTIS HC A06/MF A01 CSCL 17B

A study is performed under NASA contract to evaluate data from an AN/FPS-16 radar installed for support of flight programs at Dryden Flight Research Facility of NASA Ames Research Center. The purpose of this study is to provide information necessary for improving post-flight data reduction and knowledge of accuracy of derived radar quantities. Tracking data from six flights are analyzed. Noise and bias errors in raw tracking data are determined for each of the flights. A discussion of an altitude bias error during all of the tracking missions is included. This bias error is defined by utilizing pressure altitude measurements made during survey flights. Four separate filtering methods, representative of the most widely used optimal estimation techniques for enhancement of radar tracking data, are analyzed for suitability in processing both real-time and post-mission data. Additional information regarding the radar and its measurements, including typical noise and bias errors in the range and angle measurements, is also presented. This report is in two parts. This is part 2, a discussion of the modeling of propagation path errors.
Author

N86-13355# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
COMPARATIVE STUDY OF SPACE SEGMENTS FOR THE PROVISION OF FUTURE OPERATIONAL DATA RELAY SATELLITE SERVICES Final Report
Paris ESA Aug. 1984 387 p refs Prepared in cooperation with Erno Raumfahrttechnik GmbH and Thomson-CSF
(Contract ESA-5746/83/NL-DG)
(MBB-DSP-TN/DRS/132/84; ESA-CR(P)-2049) Avail: NTIS HC A17/MF A01

Data relay satellite (DRS) user requirements are identified in terms of required data rate, mission time, availability, and location of DRS and ground station(s). Time dependent mission scenarios are presented. The payload design is screened against constraints stemming from the user satellites. User availability requirements are translated into reliability requirements for payload and service module. European systems cost effectiveness is assessed, and alternative implementation and replenishment strategies are developed considering dedicated, combined, and functionally shared configurations for three payload categories. The resulting satellite systems are defined and a satellite/launcher matrix given for the space segment implementation alternatives. Planning and cost estimates are provided for comparison with minimum costs resulting for a system consisting of satellites of the TV-SAT/L-SAT class with combined payloads.
Author (ESA)

N86-14144# Joint Publications Research Service, Arlington, Va.
UNIQUENESS CONDITIONS IN EVALUATION OF LEAST SQUARES METHOD IN NONLINEAR SPACE NAVIGATION PROBLEMS Abstract Only
G. A. Mersov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 49 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 804-807 Original language document announced in IAA as A85-15267 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14164# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL CHECKING OF MATHEMATICAL MODEL OF EDDY CURRENTS IN ACTUATING COMPONENTS OF SYSTEMS FOR MAGNETIC ORIENTATION OF ARTIFICIAL EARTH SATELLITES AND SPACECRAFT Abstract Only
V. G. Lebedev, B. I. Rabinovich, R. I. Ashkinazi, and S. V. Viktorov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 82 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 945-947 Original language document announced in IAA as A85-19914 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14166# Joint Publications Research Service, Arlington, Va.
ORGANIZATION OF SPACE NAVIGATION SYSTEM BASED ON USE OF GEOSTATIONARY SATELLITES
V. E. Abdullayev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 90-96 Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR: Ser. Fiz.-Tekhn. i Mat. Nauk (Baku), v. 5, no. 2, Mar. - Apr. 1984 p 144-149 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-13356*# National Aeronautics and Space Administration, Washington, D. C.
REPORT ON THE FINDINGS OF THE JAPANESE INVESTIGATIVE TEAM ON US SPACE STATION DESIGN (KEIDANREN)
Sep. 1985 127 p Transl. into ENGLISH of "Homi Uchu Kichi Keika Chosatan Hokokusho, Ucho (Space)" Rept-23 Space Development Promotion Council (Keidanren), Tokyo, Japan, 1985 p 1-113 Transl. by Scientific Translation Service, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77659; NAS 1.15:77659) Avail: NTIS HC A07/MF A01 CSCL 22B

The objectives, itinerary and results of the Japanese Investigative Team on U.S. Space Station Design (Keidanren), consisting of members of the Space Development Promotion Council and representatives of Japanese industries involved in Japan's space station development effort are presented. This team visited NASA facilities in February, 1985. The objectives of the study team are to gather information on preliminary design efforts toward space station planning in Japan and the promotion of Japanese space related industries, as well as the evaluation of the present status of space environment exploitation in the U.S. This report is intended to be a basic reference for government agencies and industry in

addressing the course of action to be taken in the future development of Japan's space station participation. Author

N86-13357*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
SPACE STATION PRELIMINARY DESIGN REPORT
Sep. 1982 252 p refs
(NASA-TM-87521; NAS 1.15:87521) Avail: NTIS HC A12/MF A01 CSCL 22B

The results of a 3 month preliminary design and analysis effort is presented. The configuration that emerged consists of a very stiff deployable truss structure with an overall triangular cross section having universal modules attached at the apexes. Sufficient analysis was performed to show feasibility of the configuration. An evaluation of the structure shows that desirable attributes of the configuration are: (1) the solar cells, radiators, and antennas will be mounted to stiff structure to minimize control problems during orbit maintenance and correction, docking, and attitude control; (2) large flat areas are available for mounting and servicing of equipment; (3) Large mass items can be mounted near the center of gravity of the system to minimize gravity gradient torques; (4) the trusses are lightweight structures and can be transported into orbit in one Shuttle flight; (5) the trusses are expandable and will require a minimum of EVA; and (6) the modules are anticipated to be structurally identical except for internal equipment to minimize cost. Author

N86-13358*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
ADAPTIVE CONTROL OF LARGE SPACE STRUCTURES USING RECURSIVE LATTICE FILTERS Final Report, period ending 31 Dec. 1985
Gene L. Goglia Dec. 1985 80 p refs
(Grant NAG1-429)
(NASA-CR-176402; NAS 1.26:176402) Avail: NTIS HC A05/MF A01 CSCL 22B

The use of recursive lattice filters for identification and adaptive control of large space structures was studied. Lattice filters are used widely in the areas of speech and signal processing. Herein, they are used to identify the structural dynamics model of the flexible structures. This identified model is then used for adaptive control. Before the identified model and control laws are integrated, the identified model is passed through a series of validation procedures and only when the model passes these validation procedures control is engaged. This type of validation scheme prevents instability when the overall loop is closed. The results obtained from simulation were compared to those obtained from experiments. In this regard, the flexible beam and grid apparatus at the Aerospace Control Research Lab (ACRL) of NASA Langley Research Center were used as the principal candidates for carrying out the above tasks. Another important area of research, namely that of robust controller synthesis, was investigated using frequency domain multivariable controller synthesis methods. G.L.C.

N86-13359*# Allied Bendix Aerospace, Teterboro, N.J. Guidance Systems Div.
ASTROPHYSICAL PAYLOAD ACCOMMODATION ON THE SPACE STATION Final Report, 10 Dec. 1984 - 15 Oct. 1985
Bernard P. Woods 15 Oct. 1985 164 p refs
(Contract NAS8-36124)
(NASA-CR-178556; NAS 1.26:178556) Avail: NTIS HC A08/MF A01 CSCL 22B

Surveys of potential space station astrophysics payload requirements and existing point mount design concepts were performed to identify potential design approaches for accommodating astrophysics instruments from space station. Most existing instrument pointing systems were designed for operation from the space shuttle and it is unlikely that they will sustain their performance requirements when exposed to the space station disturbance environment. The technology exists or is becoming available so that precision pointing can be provided from the space station manned core. Development of a disturbance insensitive pointing mount is the key to providing a generic system for space station. It is recommended that the MSFC Suspended Experiment Mount concept be investigated for use as part of a generic pointing mount for space station. Availability of a shirtsleeve module for instrument change out, maintenance and repair is desirable from the user's point of view. Addition of a shirtsleeve module on space station would require a major program commitment. Author

N86-13360# European Space Tribology Lab., Risley (England).
THERMAL VACUUM TESTS ON A HINGE ACTUATOR MECHANISM
J. C. Anderson Paris ESA Jan. 1984 18 p ref
(Contract ESA-5199/NL-PP)
(ESA-ESTL-067; ESA-CR(P)-1921) Avail: NTIS HC A02/MF A01

A Hinge Actuator Mechanism (HAM) which provides a controlled rotary motion for deployment underwent tests in vacuum, over an isothermal range of temperatures from +82 to -68 C. The HAM always operates over this temperature range but the time taken for deployment (rotation through 90 deg) varies from 23.28 sec at +82C to 70.16 sec at -68C. The variation is due to the change in resistivity of the aluminum disk rotor in the eddy current brake used to control deployment speed. Also, at temperatures < -40 C, the torque of the main bearings increases due to the different thermal contractions of the aluminum alloy housings and steel shafts which results in the elimination of radial clearance in the bearings. Author (ESA)

N86-13361# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
ASSEMBLY INTEGRATION VERIFICATION (AIV) TEST EFFECTIVENESS STUDY. APPLICABILITY OF SPACELAB APPROACH FOR EQUIPMENT AND SYSTEM TEST FOR ARIANE-4 CLASS SATELLITES. VOLUME 1: EXECUTIVE SUMMARY Final Report
L. Kerstein, W. Farr, H. Maager, J. Weydandt, and Chr. Milan Paris ESA 1985 108 p Prepared in cooperation with Erno Raumfahrttechnik GmbH
(Contract ESTEC-5516/83/NL-PP(SC))
(ERNO-671/AIV-Vol-1; ESA-CR(P)-2035) Avail: NTIS HC A06/MF A01

The overall Spacelab test program on ground, in orbit verification of the Spacelab system during Spacelab mission one, including flight measurement results, test management and organization, test documentation, and test program control procedures are reviewed. Failures observed during ground testing at all levels of testing, integration stages, and flight were classified according to cause. Temperature, thermal vacuum, and random vibration tests are identified as the most effective screening test and are recommended as mandatory tests for the standard environmental test specification on equipment level. The environmental test program on equipment level and the system level assembly test procedures and methods yielded high quality flight hardware. Only two anomalies were noticed during Spacelab mission one. After the first failure investigation on ground including extensive and extreme functional and environmental test programs, the failure with the RAU 21 could not be repeated even by an additional thermal vacuum test on system level. Flight measurements on hardware suggest that the test requirements for Spacelab equipment qualification are adequate, (no requalification was necessary). Author (ESA)

N86-13362# General Electric Co., Whetstone (England). Mechanical Engineering Lab.
STUDY OF THERMAL ANALYSIS METHODS Final Report
J. J. Rebis and P. S. White Paris ESA Dec. 1984 133 p refs
(Contract ESA-5653/83/NL-PB)
(GEC-MEL12.0539; ESA-CR(P)-2045) Avail: NTIS HC A07/MF A01

Lumped parameter and finite element methods were found to be suited to spacecraft thermal analysis after a study of and spatial discretization, temporal discretization, and solution of the equations resulting from these discretizations. Advantages of finite element methods over lumped parameter are: all quantities used in the

analysis are systematically derived from the geometric model and material properties (this eliminates the preliminary calculation of conduction links and capacitance values necessary for lumped parameters); the nature of the approximation is well defined and convergence to the true solution can be demonstrated under certain conditions; explicit estimates of accuracy are possible; greater accuracy for a given number of nodes; interpolation of the results can be carried out systematically; and compatibility with mainstream stress analysis programs. Disadvantages linked to its inferior robustness, greater computer resource requirement for the same number of nodes; greater software effort required to obtain the same degree of flexibility, and lack of consistent radiation modeling can be overcome. Author (ESA)

N86-13363# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
TWO-PHASE HEAT TRANSPORT SYSTEMS: SYSTEM DEFINITION, VOLUME 1 Final Report
H. Kreeb, P. Moeller, N. H. Pennings (Royal Netherlands Aircraft Factories Fokker), R. S. Bhatti (Societe Anonyme Belge de Constructions Aeronautiques), J. P. Mathieu (Societe Anonyme Belge de Constructions Aeronautiques), and S. vanOost (Societe Anonyme Belge de Constructions Aeronautiques) Paris ESA 28 Jan. 1985 132 p refs
(Contract ESA-5669/83/NL-PB(SC))
(ESA-CR(P)-2052) Avail: NTIS HC A07/MF A01

A heat transport system for space stations (including Columbus) and platforms, with heat rejection capacity in the range 10 to 15 kW per module/platform for a 10 yr mission is defined. A two-phase flow loop driven by an electrically powered liquid pump and with capillary assisted evaporators is selected. To fulfil the requirements of narrow temperature control limits, each two-phase flow concept requires a complex control device. A modular design solution dictates the parallel configuration of all evaporators and heat pipe based radiator panels. A program culminating in integration and test of a demonstration model of the complete system is proposed. Author (ESA)

N86-13364# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Structures Dept.
STANDARDIZATION PROGRAM ON DESIGN ANALYSIS AND TESTING OF INSERTS IN NONMETALLIC SANDWICH COMPONENTS Final Report
W. H. Paul, D. Wagner, and J. Bischoff Paris ESA 1984 397 p refs
(Contract ESA-440/80/NL-AK(SC))
(TR-TS-RP-2-09-84; ESA-CR(P)-2056) Avail: NTIS HC A17/MF A01

The state of the art of insert design technology was reviewed with respect to gains, and problems when applying this technique to nonmetallic sandwich elements. For loading normal to the panel facing it is shown that a design and analysis procedure provided previously may be used for nonmetallic insert/panel design. Material data were generated for the most interesting materials. The failure criteria include static tension, compression, and fatigue life under alternating loads. Residual strength was assessed. Failure modes for in-plane loads of a CFRP facing were investigated. Tests to identify the acceptability of thermal loading with respect to the degradation of strength of potting under thermal loading, were performed. To determine the tolerable torsion of an insert, experience shows that the form locking effect between the surfaces of the potting and the inner side of the upper facing is important to achieve realistic tolerances. Author (ESA)

N86-14090*# Houston Univ., Tex. Dept. of Electrical Engineering.
CONTROL OF SPACE STATIONS Final Report
Kwang Y. Lee *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 8 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 22B

N86-14114# Joint Publications Research Service, Arlington, Va.
METHOD FOR SOLVING TWO-POINT BOUNDARY VALUE PROBLEM FOR OPTIMIZATION OF FLIGHTS WITH LOW THRUST Abstract Only
A. I. Glazkov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 26 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 842-847 Original language document announced in IAA as A85-19903 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14115# Joint Publications Research Service, Arlington, Va.
CHOICE OF OPTIMUM BOUNDARY CONDITIONS IN SPEED OPTIMIZATION PROBLEM Abstract Only
S. A. Voyevodin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 26-27 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 848-857 Original language document announced in IAA as A85-19904 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14116# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL MODELS OF NONSTATIONARY EDDY CURRENTS AND EDDY MOVEMENTS OF FLUID IN PROBLEMS OF ORIENTATION AND STABILIZATION OF ARTIFICIAL EARTH SATELLITES AND SPACECRAFT 2 Abstract Only
B. I. Rabinovich and V. M. Rogovoy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 27 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 867-874 Original language document announced in IAA as A85-19906 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14133# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL MODELS OF NONSTATIONARY EDDY CURRENTS AND EDDY MOTIONS OF FLUID IN SPACECRAFT ORIENTATION AND STABILIZATION PROBLEMS 1 Abstract Only
B. I. Rabinovich and V. M. Rogovoy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 41 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 678-692 Original language document announced in IAA as A85-15255 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14134# Joint Publications Research Service, Arlington, Va.
COMPARISON OF ENERGETICS OF OPTIMUM MANEUVERS AND TWO-IMPULSE MANEUVERS IN SOME PROBLEMS OF MOTION FROM A POINT INTO ORBIT Abstract Only
A. P. Skorokhodov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 41-42 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 693-701 Original language document announced in IAA as A85-15256 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14135# Joint Publications Research Service, Arlington, Va.
OPTIMUM CONTROL PROGRAMS IN PROBLEM OF INTERORBITAL FLIGHT WITH CONTINUOUS THRUST Abstract Only
S. A. Ishkov and V. V. Salmin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 42 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 702-711 Original language document announced in IAA as A85-15257 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14163# Joint Publications Research Service, Arlington, Va.
STABILITY OF STATIONARY MOTIONS OF TWO TETHERED BODIES IN ORBIT UNDER INFLUENCE OF GRAVITATIONAL AND AERODYNAMIC FORCES Abstract Only
Ye. M. Levin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 81 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 675-682 Original language document announced in IAA as A85-15254 (For primary

document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14199# Joint Publications Research Service, Arlington, Va.
LIST OF RECENT SOVIET SPACE LAUNCHES
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 141-143 Transl. into ENGLISH from various Russian articles (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-13365*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DE 1 RIMS OPERATIONAL CHARACTERISTICS
R. C. Olsen (Alabama Univ., Huntsville), R. H. Comfort (Alabama Univ., Huntsville), M. O. Chandler (Alabama Univ., Huntsville), T. E. Moore, J. H. Waite, Jr., D. L. Reasoner, and A. P. Biddle Oct. 1985 45 p refs
(NASA-TM-86527; NAS 1.15:86527) Avail: NTIS HC A03/MF A01 CSCL 14B

The Retarding Ion Mass Spectrometer (RIMS) on the Dynamics Explorer 1 spacecraft observes both the thermal and superthermal (<50 eV) ions of the ionosphere and inner magnetosphere. It is capable of measuring the detailed species distribution function of these ions in many cases. It was equipped with an integral electrometer to permit in-flight calibration of the detector sensitivities and variations thereof. A guide to understanding the RIMS data set is given. The reduction process from count rates to physical quantities is discussed in some detail. The procedure used to establish in-flight calibration is described, and results of a comparison with densities from plasma wave measurements are provided. Finally, a discussion is provided of various anomalies in the data set, including changes of channeltron efficiency with time, spin modulation of the axial sensor heads, apparent potential differences between the sensor heads, and failures of the radial head retarding potential sweep and of the -Z axial head aperture plane bias. Studies of the RIMS data set should be conducted only with a thorough awareness of the material presented here, or in collaboration with one of the scientists actively involved with RIMS data analysis. Author

N86-13366# Centronic Ltd., Croydon (England).
SUN ACQUISITION SENSOR FOR EUROPEAN COMMUNICATIONS SATELLITE
1985 11 p
Avail: NTIS HC A02/MF A01

A development program for a Sun acquisition sensor with 7yr in-orbit life and 5yr storage in a clean room is outlined. The design proposes P-type silicon (10 ohm/cm), nongold solder contacts, glass epoxy boards, and silicones for attaching windows to chip and chip to board. Radiation damage, raw materials, qualification tests, and packing are discussed. Author (ESA)

N86-13367# British Aerospace Dynamics Group, Bristol (England). Space and Communications Div.
DEVELOPMENT OF THE NIMBUS-7 SMMR RETRIEVAL ALGORITHM Final Report
J. E. Charlton, comp. Paris ESA Mar. 1985 113 p refs
(Contract ESA-5545/83/NL-GM(SC))
(BAe-RPT/NIM-7/021; ESA-CR(P)-2053) Avail: NTIS HC A06/MF A01

An iterative algorithm for the extraction of geophysical parameters from the sea surface and intervening atmosphere from the Nimbus 7 microwave radiometer was developed. Surface and atmospheric truth data for the North Atlantic were used to assess the algorithm. Results show that satellite data from the most northerly positioned ship appears to be contaminated by sidelobe pick-up. The derived sea surface temperature exceeds ground truth data for all ships. Insertion of biases for the satellite data considerably reduces the residuals and improves the correlations. The required biases suggest that the calibrated channel at 37 GHz for horizontal polarization, in particular, yields outputs which are too high. Changes from the windspeed model of the original program reduce the correlation of derived parameters with the ground truth. Sea surface humidity predictions are particularly good. Author (ESA)

N86-13368# Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
FEASIBILITY STUDY OF CHIRP GENERATOR FOR ERS-1 RADAR ALTIMETER, OPTION A Final Report
J. Dybedal, A. Ronnekleiv, L. P. Solie, and E. Soerlie Paris ESA Jan. 1983 150 p refs
(Contract ESTEC-4845/81/NL-PP(SC))
(ELAB-STF44-F83103; ESA-CR(P)-2058) Avail: NTIS HC A07/MF A01

The design of the surface acoustic wave (SAW) chirp line and accessory electronics, which form the chirp generator of the ERS-1 radar altimeter is reviewed. Tests on the complete generator and submodules are summarized. The expander satisfies specifications at room temperature, producing a chirp with an rms phase deviation from quadratic of 3.7 deg and a signal to noise ratio > 20 dB. The expander gates an LO signal at 300 MHz and expands it in a SAW chirp line using arrays of reflecting holes in YZ-LiNbO3. Amplitude uniformity and stability are provided by a limiter. Extension of the operational temperature range to between minus 25 and plus 55 C is possible with small modifications.
Author (ESA)

N86-14154# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF INSTRUMENTS FOR VEGA PROBES Abstract Only
A. Barshay *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 61 Transl. into ENGLISH from Sov. Kirgiziya (Frunze), 22 Jun. 1985 p 4 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-13369*# Mechanical Technology, Inc., Latham, N. Y.
HPOTP LOW-SPEED FLEXIBLE ROTOR BALANCING, PHASE 1 Final Report
J. Giordano and E. Zorzi 23 Jul. 1985 96 p
(Contract NAS8-35598)
(NASA-CR-171610; NAS 1.26:171610; MTI-85TR28) Avail: NTIS HC A05/MF A01 CSCL 21H

A method was developed that shows promise in overcoming many balancing limitations. This method establishes one or more windows for low speed, out-of-housing balancing of flexible rotors. These windows are regions of speed and support flexibility where two conditions are simultaneously fulfilled. First, the rotor system behaves flexibly; therefore, there is separation among balance planes. Second, the response due to balance weights is large enough to reliably measure. The analytic formulation of the low-speed flexible rotor balancing method is described. The results of proof-of-principle tests conducted under the program are presented. Based on this effort, it is concluded that low speed flexible rotor balancing is a viable technology. In particular, the method can be used to balance a rotor bearing system at low speed which results in smooth operation above more than one

bending critical speed. Furthermore, this balancing methodology is applicable to SSME turbopump rotors. Author

N86-14085*# American Univ., Beirut (Lebanon).
A STUDY OF SOME FEATURES OF ac AND dc ELECTRIC POWER SYSTEMS FOR A SPACE STATION Final Report
Jack I. Hanania *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 22B

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-13370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATIONS OF SYSTEM FOR ELEVATED TEMPERATURE TENSILE TESTING AND STRESS-STRAIN MEASUREMENT OF METAL MATRIX COMPOSITES
Juan O. Diaz 1985 21 p refs Presented at the 1st Symposium on Testing Technology of Metal Matrix Composites, Nashville, 18-20 Nov. 1985; sponsored by the American Society for Testing and Materials
(NASA-TM-87172; E-2813; NAS 1.15:87172) Avail: NTIS HC A02/MF A01 CSCL 11D

Composites consisting of tungsten alloy wires in superalloy matrices are being studied because they offer the potential for increased strength compared to current materials used at temperatures up to at least 1093 C (2000F). Previous research at the NASA Lewis Research Center and at other laboratories in the U.S., Europe, and Japan has demonstrated laboratory feasibility for fiber reinforced superalloys (FRS). The data for the mechanical and physical properties used to evaluate candidate materials is limited and a need exists for a more detailed and complete data base. The focus of this work is to develop a test procedure to provide a more complete FRS data base to quantitatively evaluate the composite's potential for component applications. This paper will describe and discuss the equipment and procedures under development to obtain elevated temperature tensile stress-strain, strength and modulus data for the first generation of tungsten fiber reinforced superalloy composite (TFRS) materials. Tensile stress-strain tests are conducted using a constant crosshead speed tensile testing machine and a modified load-strain measuring apparatus. Elevated temperature tensile tests are performed using a resistance wound commercial furnace capable of heating test specimens up to 1093 C (2000 F). Tensile stress-strain data are obtained for hollow tubular stainless steel specimens serving as a prototype for future composite specimens. Author

N86-13371# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE DYNAMICS OF THE PHOTOFRAGMENTATION OF KETENE 3-CYCLOPENTENONE, 3,5-CYCLOHEPTADIENONE, AND TROPONE Ph.D. Thesis
B. I. Sonobe 1985 170 p
(AD-A158045; AFIT/CI/NR-85-90D) Avail: NTIS HC A08/MF A01 CSCL 07/3

Photofragment infrared fluorescence methods were used to study energy disposal to the carbon monoxide product of ketone photodissociation. Vibrationally excited CO is formed upon photolysis at 193 nm, but not at 249 and 308 nm. The nascent CO vibrational energy distribution can be characterized by a temperature, T subscript V = 3750 K. The nascent CO rotational energy distribution can be characterized by a temperature, T subscript r = 6700 K. This suggests that ketone undergoes dissociation by a non-linear path following photoexcitation at 193 nm. Time-resolved laser absorption spectroscopy was used to study the energy partitioning in the photoactivated fragmentation of 3-cyclopentenone, 3,5-cycloheptadienone, and tropone. The CO product vibrational energy distribution was measured at photolysis wavelengths of 193, 249, and 308 nm. The experimental distributions are analyzed by comparing them with distributions calculated by using a statistical model. For 3-cyclopentenone and tropone, only the non-fixed energy of the transition state is available for partitioning among the products' vibrational degrees of freedom, whereas, for 3,5-cycloheptadienone, the full reaction exoergicity is available to be randomly distributed among all the developing products' degrees of freedom. This suggests that the products of the dissociation of 3-cyclopentenone and tropone are vibrationally decoupled from one another in the exit channel. Author (GRA)

N86-13372# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Chemistry.
FUNCTIONALIZED VESICLES AS ORGANIC REAGENTS Final Report, 1 May 1982 - 30 Jun. 1985
R. A. Moss 2 Jul. 1985 6 p
(Contract DAAG29-82-K-0122)
(AD-A158381; ARO-19175.18-CH) Avail: NTIS HC A02/MF A01 CSCL 06/1

Our scientific objective is the construction of specific organic reagents based upon functionalized surfactant vesicles. In this proposal, fully-functionalized thiol, imidazole, and hydroxyl vesicles are presented as reagents of special properties. Methods are suggested to chemically differentiate the inner and outer functionalities of multilamellar functional vesicles. Selective deactivation of exterior interior functionalities, as well as reactions which are rate-limited by permeation of substrates through the exterior bilayer of the vesicle. Liposomal systems which should esterify cholesterol are designed in analogy to the lecithin: cholesterol acyl transferase enzyme system. Vesicular systems designed to efficiently cleave toxic phosphates are to be investigated for the possible development of decontamination agents. The proposed research should have implications for synthetic organic, bioorganic, biomimetic and membrane chemistry. In fact, major progress has been made in the areas of functional vesicles, phosphate cleavage, and stereochemical selectivity in micellar systems. GRA

N86-13373# Washington State Univ., Pullman. Dept. of Chemistry.
TEMPERATURE AND PRESSURE COMPONENTS OF SHOCK-INDUCED CHANGES IN THE ELECTRONIC SPECTRUM OF CARBON DISULFIDE M.S. Thesis
R. H. Granholm Aug. 1985 60 p
(Contract N00014-77-C-0232)
(AD-A158627) Avail: NTIS HC A04/MF A01 CSCL 07/4

Liquid carbon disulfide has its first electronic transition centered at 3200 A. Shock-compression of CS2 up to about 80 kilobars has been shown to shift the red edge of this absorption band more than 1600 A towards longer wavelengths. In this work the conditions of temperature and pressure behind the shock wave are controlled to allow their separate effects on the CS2 spectrum to be determined. The shift of the band edge appears to be a function only of temperature and pressure. GRA

N86-13374# Naval Research Lab., Washington, D. C.
ELUTION OF BENZENE AND METHYL ETHYL KETONE FROM CHARCOAL BEDS BY CONTINUED AIR SWEEPING Interim Report, Mar. 1983 - Nov. 1984
J. K. Thompson, L. A. Jonas, and B. E. Walker 4 Sep. 1985 26 p
(DA Proj. F64-651)
(AD-A158804; NRL-MR-5643) Avail: NTIS HC A03/MF A01 CSCL 07/4

Activated carbon, or charcoal, is commonly used in adsorption beds to remove unwanted vapors from air in ventilating systems and in personal protective respirators. The vapor molecules become trapped by adsorption on the extensive surface of the charcoal and hence are removed for the air stream. However, this trapping is not permanent. These adsorbed molecules can desorb again into the passing air stream and be carried along to another adsorption site, where the cycle is repeated. Thus, a dose of vapor fed into a charcoal bed under a continuous flow of air

will migrate as wave through the bed and subsequently will appear as a concentration peak in the effluent air stream. The questions arise, then--especially if the vapor is a hazardous material: how long will it take for the eluted vapor dose to appear in the effluent, and what will answer these questions to some extent, and (2) to characterize the kinetics of the process in terms of the Wheeler desorption equation. Test tube-sized beds of Whetlerite were challenged with benzene or methyl ethyl ketone (MEK) in doses less that required for break-through. Then, as air sweeping continued, time and concentration of the benzene or MEK elution peaks were observed and found to be predictable functions of the dosage. The results were also analyzed by adsorption/desorption which were derived monotonci functions of the degree of carbon loading. GRA

N86-13375# Cornell Univ., Ithaca, N.Y. Dept. of Civil Engineering.
MASS TRANSFER COEFFICIENTS AND HENRY'S CONSTANTS FOR PACKED-TOWER AIR STRIPPING OF VOLATILE ORGANICS: MEASUREMENTS AND CORRELATION Final Report, Dec. 1981 - May 1984
J. M. Gosset, C. E. Cameron, B. P. Eckstrom, C. Goodman, and A. H. Lincoff Jun. 1985 302 p
(Contract F08635-82-K-0159)
(AD-A158811; ESL-TR-85-18) Avail: NTIS HC A14/MF A01 CSCL 07/4

Design of packed-tower air-stripping systems for the removal of volatile contaminants from groundwaters requires knowledge of the equilibrium constant relating air and water concentrations (Henry's constant, H), and the applicable mass transfer coefficient (K sub 1a). The objectives of this research were: to evaluate the effects of temperature, ionic strength, and the mutual presence of other organics on the H-values of five volatile compounds of concern to the USAP; and to investigate the effects of temperature, packing size and type, liquid and air loadings, and the mutual presence of other organics on the K sub 1a values of these five compounds--tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, chloroform, and methylene chloride. An innovative method for measuring Henry's constants was proposed and evaluated, termed Equilibrium Partitioning In Closed Systems (EPICS). This method relies upon measurement of the ratio of headspace concentrations from two equilibrated bottles containing equal solute masses, but possessing differing liquid volumes. H-values for the five compounds were measured over temperatures ranging from 10 to 30 C using both EPICS and batch, diffused-bubble stripping techniques. Temperature regressions for H were derived. Comparison between methods suggests that EPICS is as precise as the batch-stripping technique, and is probably more accurate, being free of mass transfer limitations. Liquid-phase diffusivity values were measured for the five study compounds at 20 C using a diaphragm diffusion cell. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N86-13376 Illinois Univ., Urbana-Champaign.
PROCESS-INDUCED VISCOELASTIC STRESS IN COMPOSITE LAMINATES Ph.D. Thesis
Robert James Stango 1985 95 p
Avail: Univ. Microfilms Order No. DA8511676

In recent years, considerable interest has developed in evaluating the stress response of composite laminates which is associated with cooling the material system from the cure temperature to room temperature. The present research examines the fundamental nature of time-dependent residual-thermal stresses in composite laminates which are caused by the extreme temperature reduction encountered during the fabrication process. Viscoelastic stress in finite-width, symmetric composite laminates is examined on the basis of a formulation which employs an incremental hereditary integral approach in conjunction with a quasi-three dimensional finite element analysis. A consistent methodology is developed and employed for the characterization of lamina material properties. Special attention is given to the time-dependent stress response at ply-interface locations near the free-edge. In addition, the influence of cooling path on stress history is examined. Recently published material property data for graphite-epoxy lamina is employed in the analysis. Dissert. Abstr.

N86-13377# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF CARBON FIBRE SURFACE TREATMENT ON MOISTURE ABSORPTION AND INTERLAMINAR SHEAR STRENGTH OF CARBON FIBRE/EPOXY RESIN COMPOSITES
O. K. Joshi May 1984 34 p
(AD-A157705; RAE-TR-84047; DRIC-BR-94905) Avail: NTIS HC A03/MF A01 CSCL 11/4

Carbon fibers surface treated to eight different levels of the standard treatment were moulded into unidirectional composites in an epoxy resin. The composites were immersed in boiling water or exposed to a hot humid environment (70C, 95% RH), and the water absorption, swelling and interlaminar shear strength were measured. The reversibility of these effects was studied initially by drying the composite at 70 C in a vacuum oven and further by repeated hygrothermal cycling. In general, more moisture was absorbed for the lower levels of surface treatment where the bond between the fiber and matrix was weaker. Studies of reversibility showed that there was a greater probability of permanent damage for low fiber matrix bond strengths and for specimens immersed in boiling water. GRA

N86-13378# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
COMPOSITES DESIGN Final Report, Jun. - Nov. 1984
S. W. Tsai and T. N. Massard Dec. 1984 144 p
(AF Proj. 2307)
(AD-A157710; AFWAL-TR-84-4183) Avail: NTIS HC A07/MF A01 CSCL 11/4

This report includes the fundamental equations for the stiffness and strength of laminated composites and two approaches to determine the optimum strength of laminates. Formulas for micromechanics and for unsymmetric laminates are simplified so that material and geometric factors can be more easily optimized than the unabridge theory. This report is intended as a source of information for designers, fabricators and researchers of composites. GRA

N86-13379# Puerto Rico Univ., Rio Piedras.
MULTIPLE SCATTERING THEORIES FOR OPTICAL PROPERTIES OF COMPOSITE MATERIALS Final Report, 15 Jun. 1981 - 15 May 1985
M. Gomez-Rodriquez 15 May 1985 101 p
(Grant DAAG29-81-G-0010)
(AD-A158270; ARO-18574-PH) Avail: NTIS HC A06/MF A01 CSCL 11/6

A theoretical model is formulated that predicts the optical properties of nonhomogeneous materials (cermets). It has been found that correlation effects due to the formation process of cermets, quantum size corrections, and renormalized corrections are essential ingredients of a realistic theory for the optical properties of cermets. This is particularly true in the high concentration regime of the metallic minority constituent (when concentration of the metal exceeds 10% volume fraction). The first smoothing approximation was used in the multiple scattering calculation in the context of the random continuum and distinct metallic island models for cermets. The T-Matrix renormalize calculation applied to the; distinct metallic island model for cermets was found to give the best predictive theory. This model predicted the frequency and height of the observed resonance in the imaginary part of the index of refraction with a high degree of precision for a wide regime of concentration and materials. GRA

N86-13380# New York Univ., New York. Inst. of Mathematical Sciences.
EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS Final

Report, 1 Sep. 1983 - 30 Nov. 1984
G. C. Papanicolaou 23 Apr. 1985 6 p
(Grant AF-AFOSR-0228-80)
(AD-A158941; Rept-5274192; AFOSR-85-0671TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

The main results of our work fall into three categories which we list in order of significance to our present and future work: (1) Focusing a singularity of the nonlinear Schrodinger equation. We have solved by a careful analytical-numerical method the basic question of what the local rate of blow-up is for solutions of the nonlinear Schrodinger equation with cubic nonlinearity in 2 space dimensions. This problem is a basic one that arises in many aspects of nonlinear wave propagation. (2) Selfdiffusion of interacting Brownian motions. Using methods of wave propagation in random media that we had developed earlier, we were able to study the effective behavior of a tagged Brownian particle in interaction with an infinite system of other such particles. (3) Bounds for effective properties of composites by analytic continuation. The analytic continuation method was known to work only for two component materials. In our work we extend it to multicomponent materials by using the theory of several complex variables. GRA

N86-13381# Naval Surface Weapons Center, Silver Spring, Md.
A METHOD TO DETERMINE DYNAMIC ELASTIC CONSTANTS OF THIN SHELL COMPOSITES BY GUIDED ULTRASONIC WAVES
J. V. Foltz, A. L. Bertram, and C. W. Anderson 15 Jun. 1985 32 p
(AD-A159025; NSWC/TR-85-186) Avail: NTIS HC A03/MF A01 CSCL 11/4

Ultrasonic techniques are used to determine the velocities of guided waves in unidirectional metal matrix composite places. Both extensional (fundamental Lamb symmetric) and in-plane shear (SH) plate wave speeds are measured via through-transmission procedures utilizing one-half megahertz broadband transducers. The values recorded for the wave speeds and the plate density are used to calculate the four reduced stiffness coefficients of the plane stress Hooke's Law relationship of the plate. This approach allows the full set of elastic constants required by designers for the analysis of a thin orthotropic plate or shell loaded in its plane to be obtained from only four ultrasonic measurements. The accuracy of the elastic constant determinations may be increased by measuring more than four wave speeds and employing the statistical data reduction method described. GRA

N86-13382# Sandia National Labs., Albuquerque, N. Mex.
ULTRASONIC LONGITUDINAL WAVE VELOCITY IN CARBON-CARBON PITCH AND PITCH/M2 SHAPE STABLE NOSETIP MATERIAL FROM 70 DEG F TO 5400 DEG F
J. H. Gieske Jun. 1985 54 p
(Contract DE-AC04-76DP-00789)
(DE85-017330; SAND-85-0853) Avail: NTIS HC A04/MF A01

A pulse echo method was used in two notched rods of carbon-carbon Pitch materials and one rod of Pitch/M2 shape stable nosetip material to measure the temperature dependence of the longitudinal wave velocity from room temperature to 5400 F. The velocity was constant to within 2% of the room temperature value for the Pitch parent material throughout the temperature range. For the Pitch/M2 material, the velocity increased to a maximum of 10% at 4000 F and then decreased rapidly. Room temperature velocities in the principal directions of the composite are also given for the two Pitch rods, which showed a 15% decrease in velocity near the ends of both rods and near the side of one rod. DOE

N86-13383# Centre d'Essais Aeronautique Toulouse (France). Lab. d'Etudes Materiaux non Metalliques.
TEST OF A MOISTURE CONDITIONING PROCEDURE USING 70 C DISTILLED WATER, INSTEAD OF A GAS ATMOSPHERE AT 70 C, 95% RELATIVE HUMIDITY Test Report [ETALONNAGE D'UN CONDITIONNEMENT HUMIDE DANS L'EAU DISTILLEE A 70 DEG C PAR RAPPORT A UNE ATMOSPHERE GAZEUSE A 70 DEG C, 95% D'HUMIDITE RELATIVE]
15 Mar. 1985 35 p In FRENCH
(M3-431000) Avail: NTIS HC A03/MF A01

The water procedure was tried in order to simplify the water conditioning of organic matrix composites. The tests were made using T-300-N5208 and Fibredux 914 composite materials. Water absorption after 750 hr is larger, but modification of the peeling resistance is very slight. Author (ESA)

N86-13384# Centre d'Essais Aeronautique Toulouse (France). Lab. M4C.
STUDY OF THE MECHANICAL PROPERTIES DISPERSION OF CARBON-EPOXY COMPOSITE MATERIALS Test Report [ETUDE DE LA DISPERSION DES PROPRIETES MECANIQUES DES MATERIAUX COMPOSITES CARBONE-EPOXY]
M. Laparliere 3 Jul. 1984 86 p In FRENCH 2 Vol.
(M2-695600-Pt-1) Avail: NTIS HC A05/MF A01

Mechanical properties of T300/N5208 and the Fibredux 914 primpregnated materials were studied. Results show a low dispersion of tensile properties, 6%CY for Fibredux 914 at 20C. The sampling zones show a small influence on the average measurements on the order of 2%. Delamination resistance is much more variable in both materials, with a higher average for the Fibredux 914. Author (ESA)

N86-13385# Centre d'Essais Aeronautique Toulouse (France). Lab. d'Etudes de Materiaux non Metalliques.
STUDY OF THE DISPERSION OF THE MECHANICAL PROPERTIES OF CARBON-EPOXY COMPOSITE MATERIALS Test Report [ETUDE DE LA DISPERSION DES PROPRIETES MECANIQUES DES MATERIAUX COMPOSITES CARBONE-EPOXY]
6 Feb. 1985 45 p In FRENCH 2 Vol.
(M2-695600-Pt-2) Avail: NTIS HC A03/MF A01

The mechanical testing of carbon epoxy composites was studied, determining the conditions of load transfer from machine to sample. The results show that the hydraulic head of the Instron 100 KN and the mechanical head of the CEAT machines do not introduce a significant flexion load on the sample. Other types of head and samples introduce up to 5,5% flexion load at 50% breaking load. Author (ESA)

N86-13443# Joint Publications Research Service, Arlington, Va.
EFFECT OF GEOMETRY OF FIBER PACKING ON CONSOLIDATION OF FIBROUS COMPOSITION MATERIALS WITH POROUS MATRIX Abstract Only
B. A. Arefyev, L. A. Bondarchuk, T. I. Pavlova, I. I. Renne, V. L. Tikhmyanov, and V. K. Ushakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 16 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Mater. (Moscow), no. 2, Mar. - Apr. 1985 p 127-130 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13444# Joint Publications Research Service, Arlington, Va.
CONDUCTIVITY OF METAL-CERAMIC MULTILAYER ZrO2-Mo AND Mo-BASED COMPOSITE MATERIALS Abstract Only
S. M. Kats, Z. I. Bylkova, V. N. Bogin, A. P. Filichkin, and N. G. Chubenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 16 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Feb. 1984 p 61-64 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13445# Joint Publications Research Service, Arlington, Va.
PRODUCTION OF MULTILAYER MAGNETIC SURFACE OF MAGNETICALLY SOFT COMPOSITE MATERIALS Abstract Only
A. E. Ritso, O. A. Katrus, A. A. Laansoo, and R. A. Siymar *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 17 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Feb. 1985 p 70-73 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13446# Joint Publications Research Service, Arlington, Va.
CALCULATION OF DAMPING PROPERTIES OF COMPOSITE MATERIALS Abstract Only
V. N. Brinza, B. S. Vekshin, and Ye. V. Kolyadina *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 17 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Chernaya Met. (Moscow), no. 1, Jan. 1985 p 79-81 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13447# Joint Publications Research Service, Arlington, Va.
THEORY OF PYROLYSIS OF COMPOSITE POLYMER MATERIAL Abstract Only
A. M. Grishin and S. P. Sinitsyn *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 18 Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), v. 20, no. 6, Nov. - Dec. 1984 p 67-69 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13448# Joint Publications Research Service, Arlington, Va.
CRITICAL BEHAVIOR OF THERMOELECTRIC POWER IN BINARY COMPOSITE MATERIALS Abstract Only
A. S. Skal *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 18 Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 88, no. 2, Feb. 1985 p 516-521 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13459# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF POROSITY OF THIN SHEETS OF FIBER MATERIALS BASED ON OPTICAL TRANSMISSION COEFFICIENT Abstract Only
A. G. Kostornov, O. V. Kirichenko, S. P. Sakhno, and G. S. Tymchik *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 35 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1984 p 86-90 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13623# Joint Publications Research Service, Arlington, Va.
RECENT ADVANCES IN COMPOSITE MATERIALS REVIEWED
Laurent Schwartz *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 1-2 Transl. into ENGLISH from Ind. et Tech. (Paris), 10 Apr. 1985 p 18 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-13386 Connecticut Univ., Storrs.
AN INVESTIGATION OF PLASMA JET IGNITION AND FLAME JET IGNITION OF LEAN FUEL-AIR MIXTURES Ph.D. Thesis
Durga Nageswara Mittinti 1985 241 p
Avail: Univ. Microfilms Order No. DA8512152

Plasma jet ignition (PJI) is investigated in a cylindrical combustion bomb using methane-air at an equivalence ratio of 0.7. The effects of plasma chamber size and its aspect ratio (depth to diameter of the cavity), spark energy and its duration, plasma medium such as (CH4), (CH4+7O2),(CH4+6O2) and (H2), and the effect of initial pressure are explored. The results are assessed in terms of a combustion index which is a function of the peak pressure and the time the peak is reached. It is found that besides the plasma cavity and orifice size, the aspect ratio and the spark duration have significant influence on the combustion index and there exist optimum values for each plasma chamber. Improved performance is observed with the plasma media of (CH4), (H2) and more significantly with (CH4+6O2+NO2). As the initial pressure is increased, the combustion index is found to decrease. Flame jet ignition (FJI) is developed using (H2+1/2O2) for the initiating flame and methane-air or propane-air mixture in the main chamber. FJI is found to be more effective than PJI.
Dissert. Abstr.

N86-13387 California Univ., Berkeley.
THERMAL RADIATION EFFECTS ON COMBUSTION OF CONDENSED FUELS Ph.D. Thesis
Kwi Young Lee 1984 110 p
Avail: Univ. Microfilms Order No. DA8512898

The effect of thermal radiation on combustion of condensed fuels is studied through simple but realistic mathematical models. Specific subjects investigated in the present study are the determination of radiation blockage, its effects on solid fuel ignition, and the combined radiation and conduction effect on cold-wall flame-quenching.
Dissert. Abstr.

N86-13388# Army Fuels and Lubricants Research Lab., San Antonio, Tex.
REPORT ON INVESTIGATION OF ALCOHOL COMBUSTION ASSOCIATED WEAR IN SPARK IGNITION ENGINES, MECHANISMS AND LUBRICANT EFFECTS Interim Report, Sep. 1976 - Dec. 1984
D. W. Naegeli and E. C. Owens Dec. 1984 93 p
(Contracts DAAK70-85-C-0007; DAAK70-78-C-0001; DAAK70-79-C-0175; DE-AI01-79CS-50030)
(AD-A157714; AFLRL-176) Avail: NTIS HC A05/MF A01 CSCL 21/2

An investigation of the effects of alcohol fuels on spark ignition engine wear and deposition was jointly sponsored by the U.S. Department of Energy and the U.S. Army Belvoir Research and Development Center. This research has investigated four alcohol-containing fuels: pure methanol, pure ethanol, methanol in unleaded gasoline, and ethanol in unleaded gasoline (gasohol). Tests were conducted using a variety of single-cylinder research engines and production multicylinder engines, mounted in dynamometer test stands. This testing indicated that pure alcohol fuels reduced the buildup of engine deposits. Also, neat methanol greatly increased engine wear rates at engine temperatures below 75 C, while anhydrous ethanol and the alcohol-gasoline blends did not increase wear rates over that of unleaded gasoline. Engine-based tests were conducted to investigate the effects of variations in lubricant base stocks and additive formulations on the wear observed with methanol. To determine interaction between fuel alcohols and engine metals, two approaches were developed. The role of nitrogen in the wear process was studied by operating a 2.3-liter engine fueled with methanol in a nitrogen-free atmosphere. Bench experiments indicated that formic-acid and peroxides are formed as methanol combustion intermediates.
GRA

N86-13389# York Univ., Toronto (Ontario). Dept. of Chemistry.
RELATIONSHIPS BETWEEN ELECTRONIC SPECTROSCOPY AND ELECTROCHEMISTRY. A PROBE OF REORGANISATION ENERGIES
E. S. Dodsworth and A. B. P. Lever May 1985 18 p
(Contract N00014-78-C-0592)
(AD-A157940; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

The electronic spectra and electrochemical potentials of the species Ru(bipy)x(NN)3-x(2+)(bipy = 2,2'-bipyridine, NN = unsaturated diimine, x = 1,2) are correlated via fundamental relationships involving reorganization and solvation energies. It is argued that the presence of two distinct Ru yields ligand charge transfer transitions allows comparison of the reorganization energies therefore.
GRA

N86-13390# Catholic Univ. of America, Washington, D.C. Dept. of Chemistry.
REACTION INTERMEDIATES IN AROMATIC FUEL COMBUSTION Final Report, 18 Jul. 1983 - 17 Jul. 1984

W. A. Sanders 17 Jul. 1984 25 p
(Contract N00014-83-K-0586)
(AD-A158029) Avail: NTIS HC A02/MF A01 CSCL 21/4

The oxidation of benzene under fuel-lean conditions has been studied from 1600 to 2300 K in a shock tube using a stabilized CW CO laser to monitor CO production. The result of the kinetic modeling of the CO formation according to the global mechanism of Fujii and Asaba indicates that the rate of CO formation in the early stage of oxidation depends very sensitively on the rate-limiting unimolecular decomposition of benzene. The rate constant obtained for the initiation reaction using a scheme consisting of a set of 25 reactions is given for the pressure range of 1.9 - 2.7 atm. GRA

N86-13391# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DIFFERENTIAL SCATTERING CROSS SECTION AND TOTAL EXTINCTION MEASUREMENTS ON (CH)n SPHERES IN 632.8 nM LASER LIGHT M.S. Thesis
J. M. Dorman 1985 108 p
(AD-A158044; AFIT/CI/NR-85-69T) Avail: NTIS HC A06/MF A01 CSCL 07/4

A new laboratory system for aerosol research is discussed from the aspects of design, construction and preliminary testing. The system is subdivided into two cooperating subsystems known as the Optical System (OS) and the Aerosol Circulation/Sampling System (ACSS). Measurement of the extinction, scattering and absorption cross sections of an aerosol is the object of the Optical System. Aerosol production, containment, and sampling are the tasks of the ACSS. Mie scattering theory for monodisperse aerosols is discussed as it applies to the cross section measurements. Preliminary measurements on Polystyrene microspheres (1.0 micron in diameter) are presented. These measurements strongly indicate that the spheres are actually 0.85 micron in diameter. Problem areas in both the hardware and experimental procedure are presented as a precursor to full scale testing and calibration. GRA

N86-13392# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ELECTRONIC DETECTION OF LOW CONCENTRATIONS OF ORGANOPHOSPHORUS COMPOUNDS WITH A SOLID STATE DEVICE UTILIZING SUPPORTED COPPER + CUPROUS OXIDE ISLAND FILMS Ph.D. Thesis
E. S. Kolesar, Jr. May 1985 565 p
(AD-A158181; AFIT/CI/NR-85-56D) Avail: NTIS HC A24/MF A01 CSCL 07/3

This research is concerned with investigating the electronic properties modified by the exposure of a supported island film of copper + cuprous oxide to low concentrations (1-650 ppm) of diisoprophyl methylphosphonate (DIMP), and the merit of integrating these films with the distributed RC notch network detection device. Electron microscopy and associated diffraction measurements confirmed the film's structure and composition; Auger spectroscopy verified the adsorption of DIMP. DIMP exposure sensitivity is maximized for films with thicknesses less that 80A operated at 90C which have an applied bias greater than 10 volts (direct current). The adsorption of DIMP is quasi-reversible; that is, after a conditioning exposure and purge, the effect of successive challenges and expiations was monitored via corresponding changes in the film's conductivity. Exposure experiments for changes in resistance versus time were fitted to a two-dimensional nucleation and growth model. GRA

N86-13393# Research Triangle Inst., Research Triangle Park, N.C.
STUDY OF MEAN FREE PATH EFFECTS ON GROWTH OF ULTRAFINE METALLIC AEROSOLS Annual Report, 1 Feb. 1984 - 1 Feb. 1985
P. A. Lawless Apr. 1985 20 p
(Contract F49620-84-C-0017)
(AD-A158206; AFOSR-85-0525TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

In the first year of this study on the dynamics of aerosol formation in gaseous atmospheres, the experimental facility was set up, using an exploding wire generator for the production of high concentrations of metallic aerosols. The initial experiments have been devoted to development of sampling methods for the reduced atmosphere environment and, then, to the observation of the types of behavior exhibited by single component aerosols. GRA

N86-13394# California Univ., Santa Barbara. Dept. of Chemistry.
SYNTHESIS, STRUCTURE AND REACTIVITY OF MOLECULES ATTACHED TO ELECTRODE SURFACES Final Report, 15 Apr. 1981 - 15 Apr. 1985
A. T. Hubbard 10 Jul. 1985 43 p
(Grant AF-AFOSR-0149-81)
(AD-A158621; AFOSR-85-0627TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

This project was to determine the structure, orientation, composition and reactivity of the surface molecular species which form spontaneously when metals come into contact with fluids, as in batteries, fuels cells, electronic circuits, marine environments and the atmosphere. These include: determination of the spatial orientations and mode of attachment of typical organic molecules chemically bonded to electrode surfaces; discovery that each orientation of an adsorbed molecule reacts differently; identification and exploration of variables which influence adsorbate orientation (concentration, temperature, potential, electrolyte, solvent, substrate, surface structure, pH and hydrogen bonding); exploration of the influence of oriented adsorbates on electrode rates; preparation of well-defined surfaces under atmospheric conditions; electrodeposition of highly ordered layers of Ag and Cu onto well-defined substrates; discovery of the orderedness of adsorbed ionic layers at well-defined surfaces; direct experimental exploration of the cation-selectivity of metal-solution surfaces. These findings were made possible by a unique combination of surface research techniques in ultra-high vacuum and electrochemistry in solution, employed in a long-term systematic series of investigations. GRA

N86-13395# Allied Corp., Morristown, N.J.
ROLE OF ADDITIVES IN MINIMIZING ZINC ELECTRODE SHAPE CHANGE: THE EFFECT OF LEAD ON THE KINETICS OF Zn(2) REDUCTION IN CONCENTRATED ALKALINE MEDIA Final Technical Report, 20 Sep. 1982 - 20 Sep. 1984
L. S. Melnicki, I. Lazic, and D. Cipris Jul. 1985 88 p
(Contract N00014-82-C-0701)
(AD-A158806) Avail: NTIS HC A05/MF A01 CSCL 07/4

The kinetics of zinc deposition in various media is among the most widely studied systems, along with hydrogen and oxygen reactions. The importance of the zinc electrode originates from the use of zinc as an anode material in commerically important primary and secondary batteries. The Ag-Zn battery, commerically available for a long time, has the highest practical energy and power densities among conventional secondary batteries. The Ni-Zn secondary battery is still under development. Both zinc electrodes operate in concentrated alkaline electrolytes. In spite of the extensive number of studies, the mechanism of zinc reduction in alkaline media is not fully understood. The situation is further complicated in the presence of various metallic additives, which are commonly used in secondary alkaline batteries utilizing zinc anodes to suppress dendrite formation and/or facilitate uniform zinc deposition. Non-uniform zinc deposition leads to the phenomenon known as zinc electrode shape change in secondary batteries. The zinc electrode shape change is considered a leading factor in the premature loss of capacity of zinc batteries and to a generally unacceptably short cycle life. Of all the additives employed, lead appears to be the most commonly used in commercial practice, alone or in combination with other additives. While further work is in order (especially on the dissolution process of zinc, which is also affected by lead) our results point to the possibility of employing electrolyte additives, as opposed to additives to the ZnO paste in practical cells. GRA

N86-13396# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL INVESTIGATION OF MAGNESIUM COMBUSTION IN STEAM Contractor Report, Dec. 1984 - May 1985
Y. Chozev and J. Kol Jul. 1985 53 p

(AD-A159109; NPS67-85-004CR) Avail: NTIS HC A04/MF A01 CSCL 21/2

This paper presents a summary of the experimental results and studies of magnesium combustion in steam. The major subject of these studies was to measure the temperature of magnesium particles after the particles had been ejected from an exploding wire. The distribution of particle temperature along the track was measured by the two-color photo-pyrometry method (TC-PPM). A scanning microdensitometer served as a major data reduction tool in analyzing the film density due to the particle tracks as recorded on calibrated film. The initial temperature of the particle ejection from the plasma and at the beginning of combustion is 3430 K + or - 9.1%. At the initial phase of combustion, the particle consists of pure magnesium with spectral emissivity of about 0.25. During the combustion process, magnesium oxide is formed locally on the particle surface. The oxide is in liquid state with emissivity of 0.9. In the second stage of combustion there are changes on the particle surface in correlation with optical density variation and explained by emissivity variations due to peeling of the oxide film and exposure of the pure magnesium surface. Solidification of the particle, which is magnesium oxide, is observed at the measured temperature of 3125 K + or - 5.7%. The spearpoint effect, which is known in the literature as the Blick Effect, was observed at the end of the particle track. The particle supercools below the normal freezing point and then suddenly crystallizes. GRA

N86-13397# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
NO CHEMISORPTION ON NI(111): COVERAGE EFFECTS, SITE PREFERENCES AND ADSORPTION GEOMETRY Interim Technical Report
S. S. Sung, R. Hoffman, and P. A. Thiel 3 Sep. 1985 44 p
(Contract N00014-82-K-0576)
(AD-A159110; TR-14) Avail: NTIS HC A03/MF A01 CSCL 07/4

Several possible rationales for the different NO adsorption states observed on a Ni(111) surface are discussed, based on the tight binding calculations of the extended Huckel type. In the two-fold bridge site, as the coverage of NO increases, for perpendicularly adsorbed NO the N-O bonding increases and N-Ni bonding decreases. For slightly bent NO at low coverage and perpendicular NO at high coverage the same trends are obtained. These trends are consistent with the observed N-O, N-Ni stretching frequency change. At coverage 1/3, and in the perpendicular geometry, both N-O bonding and N-Ni bonding increase when NO changes adsorption sites form three-fold to two-fold or from two-fold to on-top. In the on-top site we calculate that both N-O bonding and N-Ni bonding increase when NO changes geometry from bent to perpendicular. In the two-fold bridge site the effect of bending is to produce similar but smaller trends. Author (GRA)

N86-13398# Colorado Univ., Boulder.
STUDIES OF METAL/CARBON SURFACE CHEMISTRY Report, 1 Mar. - 31 May 1985
B. E. Koel 30 Jun. 1985 6 p
(Contract DE-FG22-84PC-70779)
(DE85-015548; DOE/PC-70779/T1) Avail: NTIS HC A02/MF A01

The purpose of this research is to identify stable surface species formed from molecular adsorption and reaction on metal/carbon surfaces. This research has practical application in improving the fundamental understanding of catalytic coal gasification. Well-defined model catalysts for carbon gasification will be studied by vapor depositing alkali and transition metal atoms on carbon surfaces. Vibrational spectroscopy using HREELS and photoelectron spectroscopy of these surfaces will be used to develop an atomic-level understanding of the chemical bonding, structure, and reactivity of the metal carbon surface and of the adsorbed molecular species. DOE

N86-13399# Lawrence Livermore National Lab., Calif.
CONDENSED MATTER AT HIGH SHOCK PRESSURES
W. J. Nellis, N. C. Holmes, A. C. Mitchell, H. B. Radousky, and D. Hamilton 12 Jul. 1985 14 p refs Presented at the 15th Intern. Symp. on Shock Waves and Shock Tubes, Berkeley, Calif., 29 Jul. 1985
(Contract W-7405-eng-48)
(DE85-016443; UCRL-92974; CONF-850767-3) Avail: NTIS HC A02/MF A01

Experimental techniques are described for shock waves in liquids: Hugoniot equation-of-state, shock temperature and emission spectroscopy, electrical conductivity, and Raman spectroscopy. Experimental data are reviewed and presented in terms of phenomena that occur at high densities and temperatures in shocked He, Ar, N2, CO, SiO2-aerogel, H2O, and C6H6. The superconducting properties of Nb metal shocked to 100 GPa (1 Mbar) and recovered intact are discussed in terms of prospects for synthesizing novel, metastable materials. Ultrahigh pressure data for Cu is reviewed in the range 0.3 to 6TPa (3 to 60 Mbar). DOE

N86-13400# Lawrence Livermore National Lab., Calif.
SORPTION DETECTOR SYSTEM FOR CHEMICAL AGENTS DETECTION AND RECOGNITION
D. Olness and T. Hirschfeld 22 Mar. 1985 54 p
(Contract W-7405-eng-48)
(DE85-012775; UCID-20047) Avail: NTIS HC A04/MF A01

The use of the piezoelectric sorption sensor, in which an analyte's absorption in a thin surface layer on a piezoelectric vibrator changes its resonant frequency, has been extensively described. In every instance, the chemical selectivity of the devices hinges on that of the absorbing layer. In a complex environment, a few analytes are so distinctive as to permit this. An alternative approach uses an array of crystals (or of vibrational nodes in a microlithographically cut multivibrator) covered with a number of different absorbing layers. These are so thin that they operate in the saturation mode, with different partition coefficients against air resulting in different frequency shifts for each layer. The behavior in Fourier space of these frequency shifts is then used for pattern recognition of individual chemicals. Mixture overlap can then be handed via time derivative measurements, factor analysis, or correlation spectroscopy. Experimental results from this combination of chemometrics and their Fourier transform mechanical spectroscopy are given. Experimental results of the demonstrated feasibility of a procedure for providing complete selectivity to quartz piezobalance sensors, by using an array of different sensor layers and pattern recognition, are presented. A laboratory test system, based on this technology, is described. DOE

N86-13401# National Bureau of Standards, Boulder, Colo. Center for Chemical Engineering.
SUPERCRITICAL FLUID PROPERTIES Final Report, 1 Oct. 1983 - 31 Oct. 1984
J. F. Ely 1984 68 p refs
(Contract DE-AI05-83OR-21374)
(DE85-011203; DOE/OR-21374/T1) Avail: NTIS HC A04/MF A01

During the past decade there has been intense interest in chemical processing with supercritical fluids as solvents. In this report some preliminary results which bear upon the use of supercritical fluids, carbon dioxide in particular, in chemical processing. Two distinct sets of results are presented in the report: (1) a preliminary wide range equation of state for pure C02, and (2) some preliminary results obtained with a predictive model for mixture thermodynamic properties based on the hard sphere expansion theory. DOE

N86-13402# Lawrence Livermore National Lab., Calif.
INTERACTIONS BETWEEN A LAMINAR FLAME AND END GAS AUTOIGNITION
W. J. Pitz and C. K. Westbrook 15 Jan. 1985 18 p refs Presented at 10th Intern. Colloq. on Dyn. of Explosions and Reactive Systems, Berkeley, Calif., 4 Aug. 1985
(Contract W-7405-eng-48)
(DE85-008957; UCRL-92295-1; CONF-850830-1) Avail: NTIS HC A02/MF A01

A numerical model combining one dimensional fluid mechanics and detailed chemical kinetics is used to examine the interactions between laminar flame propagation and end gas autoignition at high temperatures and pressures of approximately 30 atmospheres. The flame is found to have very little influence on the computed rates of fuel-air autoignition in the end gas, but the subsequent high rate of heat release during autoignition is shown to produce strong acoustic waves in the burned gases. The effects of temperature fluctuations in the end gas on the locations at which autoignition is initiated is also investigated numerically. DOE

N86-13576# United Technologies Research Center, East Hartford, Conn.
RESONANT CARS DETECTION OF OH RADICALS Abstract Only
James F. Verdieck *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13607# Joint Publications Research Service, Arlington, Va.
APPLICATION OF COMPUTERS IN ANALYTICAL CHEMISTRY: CALCULATION OF OPTIMUM ACIDITY OF REACTION BETWEEN METAL IONS AND ORGANIC REAGENTS IN SOLUTION
Zhang Sunwei, Pan Fuyou, Yan Jian, and Kong Fangming *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 100-104 refs Transl. into ENGLISH from Hangzhou Daxue Xuebao (Hangzhou), v. 12, no. 1, Jan. 1985 p 98-102 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-14081*# Houston Univ., Clear Lake, Tex. Programs in Science.
ELECTRON MICROSCOPIC OBSERVATIONS OF HYDROGEN IMPLANTATION IN ILMENITES Final Report
Goerge E. Blanford *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 07D

N86-14082*# Arkansas Coll., Batesville.
A PYROLOYSIS TECHNIQUE FOR DETERMINING MICROAMOUNTS OF HYDROGEN IN LUNAR SOIL USING THE HELIUM IONIZATION DETECTOR Final Report
Roberta Bustin *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 p 13 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-13403 Illinois Univ., Urbana-Champaign.
HYDROGEN TRANSPORT AND HYDROGEN EMBRITTLEMENT IN STAINLESS STEELS Ph.D. Thesis
Tsong-Pyng Perng 1985 200 p
Avail: Univ. Microfilms Order No. DA8511659

In order to understand the kinetics of gaseous hydrogen-induced slow crack growth (SCG) in metastable austenitic stainless steels, hydrogen permeation and/or cracking velocity were measured and compared for three types of stainless steels. These included austenitic, ferritic, and duplex alloys. Deformation in AISI 301 resulted in various amounts of martensite, which enhanced the effective hydrogen diffusivity and permeability. No phase transformation was observed in deformed AISI 310. The effective hydrogen diffusivity in this alloy was slightly reduced after plastic deformation, presumably by dislocation trapping. In either the dynamic or static tensile test, AISI 301 exhibited the greatest hydrogen embrittlement and therefore the highest SCG velocity among all the alloys tested. The SCG velocity was believed to be controlled by the rate of accumulation of hydrogen in the embrittlement region ahead of the crack tip and therefore could be explained with the hydrogen transport parameters measured from the permeation experiments. Dissert. Abstr.

N86-13404 Illinois Univ., Urbana.
CORROSION FATIGUE INITIATION AND SHORT CRACK GROWTH IN AN ALUMINUM ALLOY Ph.D. Thesis
Yen-How Huang 1985 174 p
Avail: Univ. Microfilms Order No. DA8511619

A prepitted specimen with a single pit provided a favorable condition for observing crack initiation. Initiation and early growth of corrosion fatigue cracks was followed optically in pre-pitted Al-5454-H32 specimens. Supplementary fractographic, electrochemical and microstructural observations were made. The role of the microstructure with pancake-like grains (approx. 45 micrometers thick) was investigated. Testing was run under load control with R = 0.1,f = 20Hz and various stress ranges in dry air, in 0.5M NaCl at external potentials lower than E sub p (= 735 mV sub sec) or in 0.5M Na2SO2 at several potentials. Dissert. Abstr.

N86-13405 Stanford Univ., Calif.
THE INFLUENCE OF MICROSTRUCTURE ON TEMPER EMBRITTLEMENT OF LOW ALLOY STEEL Ph.D. Thesis
James Edward Wittig 1985 309 p
Avail: Univ. Microfilms Order No. DA89511368

Temper enbrittlement in steels can occur from exposure to temperatures of 300 to 600 C. Segregation of impurities, such as phosphorus, to prior austenite grain boundaries promotes intergranular fracture. In the present investigation, the influence of the steel microstructure on the segregation of phosphorus and the resulting fracture behavior is considered. This project uses analytical electron microscopy of thin foils and extraction replicas of precipitates to study temper embrittlement in two types of steel. One contains 3.5 wt% nickel, 1.7% chromium, 0.6% molybdenum, and 0.1% vanadium, and the other has the same nickel and chromium composition but without molybdenum and vanadium. Both have a bainitic microstructure and identical amounts of carbon, 0.25%, and phosphorous, 0.02%. Comparison of these two alloys reveals the effect of molybdenum on the temper embrittlment phenomenon. Dissert. Abstr.

N86-13406*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FABRICATION AND EVALUATION OF SUPERPLASTICALLY FORMED/WELD-BRAZED CORRUGATED COMPRESSION PANELS WITH BEADED WEBS
Dick M. Royster, Randall C. Davis, Joseph M. Shinn, Jr., Thomas T. Bales, and H. Ross Wiant Nov. 1985 31 p refs
(NASA-TP-2512; L-15988; NAS 1.60:2512) Avail: NTIS HC A03/MF A01 CSCL 11F

A study was made to investigate the feasibility of superplastically forming corrugated panels with beaded webs and to demonstrate the structural integrity of these panels by testing. The test panels in the study consist of superplastically formed titanium alloy Ti-6Al-4V half-hat elements that are joined by weld-brazing to titanium alloy Ti-6Al-4V caps to form either single-corrugation compression panels or multiple-corrugation compression panels. Stretching and subsequent thinning of the titanium sheet during superplastic forming is reduced by approximately 35 percent with a shallow half-hat die concept instead of a deep die concept and results in a more uniform thickness across the beaded webs. The complete panels are tested in end compression at room temperature and the results compared with analysis. The heavily loaded panels failed at loads approaching the yield strength of the titanium material. At maximum load, the caps wrinkled locally accompanied with separation of the weld-braze joint in the wrinkle. None of the panels tested, however, failed catastrophically in the weld-braze joint. Experimental test results are in good agreement with structural analysis of the panels. Author

N86-13407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POLYMER, METAL AND CERAMIC MATRIX COMPOSITES FOR ADVANCED AIRCRAFT ENGINE APPLICATIONS
D. L. McDanels, T. T. Serafini, and J. A. DiCarlo 1985 26 p refs Presented at the Advanced Composites Conference, Detroit, 3-4 Dec. 1985; sponsored by ASME
(NASA-TM-87132; E-2746; NAS 1.15:87132) Avail: NTIS HC A03/MF A01 CSCL 11F

Advanced aircraft engine research within NASA Lewis is being focused on propulsion systems for subsonic, supersonic, and hypersonic aircraft. Each of these flight regimes requires different types of engines, but all require advanced materials to meet their goals of performance, thrust-to-weight ratio, and fuel efficiency. The high strength/weight and stiffness/weight properties of resin, metal, and ceramic matrix composites will play an increasingly key role in meeting these performance requirements. At NASA Lewis, research is ongoing to apply graphite/polyimide composites to engine components and to develop polymer matrices with higher operating temperature capabilities. Metal matrix composites, using magnesium, aluminum, titanium, and superalloy matrices, are being developed for application to static and rotating engine components, as well as for space applications, over a broad temperature range. Ceramic matrix composites are also being examined to increase the toughness and reliability of ceramics for application to high-temperature engine structures and components. Author

N86-13408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF COBALT CONTENT IN U-700 TYPE ALLOYS ON DEGRADATION OF ALUMINIDE COATINGS
I. Zaplatynsky Nov. 1985 15 p refs
(NASA-TM-87173; E-2798; NAS 1.15:87173) Avail: NTIS HC A02/MF A01 CSCL 11F

The influence of cobalt content in U-700 type alloys on the behavior of aluminide coatings is studied in burner rig cyclic oxidation tests at 1100C. It is determined that aluminide coatings on alloys with higher cobalt offer better oxidation protection than the same coatings on alloys containing less cobalt. Author

N86-13409*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURRENT VIEWPOINTS ON OXIDE ADHERENCE MECHANISMS
J. L. Smialek and R. Browning 1985 17 p refs Presented at the 168th Meeting of the Electrochemical Society, Las Vegas, Nev., 15-18 Oct. 1985
(NASA-TM-87168; E-2806; NAS 1.15:87168) Avail: NTIS HC A02/MF A01 CSCL 11F

Additional hot stage Auger experiments have provided surface segregation data for NiCrAl + or - Y or Zr alloys in agreement with other investigations. This data, combined with experimental and theoretical evidence of the Al2O3-metal bond strength, is presented in support of a chemical mechanism of Al2O3 scale adhesion. Both the detrimental effects of sulfur segregation and the beneficial effects of dopant segregation may be important. Chemical features of the dopants are compared in light of these proposed mechanisms, namely delta H sub f (sulfide), delta H sub f (oxide), electron orbital configuration, and insolubility in Ni. Author

N86-13410# Department of the Air Force, Washington, D.C.
TECHNIQUE OF ASSEMBLING STRUCTURES USING VAPOR PHASE SOLDERING Patent Application
N. C. Peterson, inventor (to Air Force) Filed 19 Oct. 1984 15 p
(AD-D011805; US-Patent-Appl-SN-663015) Avail: NTIS HC A02/MF A01 CSCL 13/8

This patent application pertains to a vapor phase process for assembling parts of a lightweight structure of aluminum having a multitude of joints. The process includes the following steps: (1) cleaning surfaces of all the parts; (2) selectively depositing on the surfaces a layer of nickel and then tin; (3) selectively plating on the tin layer where joints occur a lead/tin eutectic alloy solder; (4) add flux; (5) fixturing the parts together to form the structure; (6) heating the structure in a vapor phase apparatus; (7) removing the structure from the fixture; and (8) cleaning the structure. By using the above process an antenna faceplate having over 3000 joints was soldered. Author (GRA)

N86-13411# Naval Surface Weapons Center, Silver Spring, Md.
ZIRCONIUM AS A STRUCTURAL MATERIAL FOR NAVAL SYSTEMS
W. A. Ferrando 29 Mar. 1985 57 p
(NR Proj. F61-545)
(AD-A158201; NSWC/TR-85-48) Avail: NTIS HC A04/MF A01 CSCL 11/6

The important basic physical properties and steps in the manufacture of elemental zirconium and several of its important alloys are discussed. Once considered prohibitively expensive for structural uses, its current cost is becoming competitive with other special alloys for various industrial applications. Its actual life cycle cost in many cases has been considerably lower than that experienced with alternative materials. Some of the physical properties of zirconium which make it particularly attractive for naval use include: high strength (particularly when alloyed), outstanding resistance to all forms of corrosion in seawater (and most other) environments, superior fatigue resistance, and good metallurgical workability. Its oxide compound zirconia has recently become a base material for a new generation of tough ceramics of potential structural use. These ceramics are also candidates for fiber reinforcement. Several modern ceramic fabrication techniques are discussed. Although its moderately high density probably will preclude widespread aerospace usage, zirconium and zirconium-based materials could find extensive application in naval surface systems. Finally, there is a ready availability of the raw ore from friendly nations and a very abundant domestic supply, should other sources fail. This assurance certainly increases the attractiveness of these materials for future Navy needs. GRA

N86-13412# Martin Marietta Labs., Baltimore, Md.
THE DELAYED FRACTURE OF ALUMINUM ALLOYS Final Report
J. R. Pickens, T. J. Langan, and J. A. S. Green Jun. 1985 38 p
(Contract N00014-84-C-0380)
(AD-A158944; MML-TR85-39(C)) Avail: NTIS HC A03/MF A01 CSCL 11/6

The major developments in understanding the mechanisms of stress-corrosion cracking (SCC) in Al-Zn-Mg and Al-Mg alloys are briefly reviewed. In particular, evidence for the involvement of hydrogen embrittlement in the SCC mechanisms is addressed. Specifically, the effect of the loading mode on SCC, the role of grain boundary segregation in cracking, and our overall view of the mechanisms of SCC are discussed. GRA

N86-13413# Naval Postgraduate School, Monterey, Calif.
EFFECT OF TEMPERATURE AND STRAIN RATE ON MICROSTRUCTURE OF A DEFORMED, SUPERPLASTIC Al-10%Mg-0.1%Zr ALLOY M.S. Thesis
D. B. Berthold Jun. 1985 91 p
(AD-A159015; AD-F620001) Avail: NTIS HC A05/MF A01 CSCL 11/6

Development of microstructure during thermomechanical processing of an Al-10%Mg-0.1%Zr alloy was examined in the initial portion of this research. The thermomechanical processing involved solution treating; not working by upset forging at 440 C followed by warm rolling material were deformed at three strain rates at temperatures of 200 C, 300 C, and 400 C and were microstructurally examined. It is found that this alloy statically recrystallizes prior to commencing a test at 400 C, the resultant grains deform by boundary sliding and there is extensive cavitation. During lower temperature deformation it was found that either continuous recrystallization or just with no recrystallization occurs and little or no cavitation takes place. GRA

N86-13414# Naval Postgraduate School, Monterey, Calif.
EFFECT OF STRAIN AND STRAIN RATE ON THE MICRO-

STRUCTURE OF A SUPERPLASTICALLY DEFORMED Al-10%Mg-0.1%Zr ALLOY M.S. Thesis
M. E. Alcamo Jun. 1985 123 p
(AD-A159062) Avail: NTIS HC A06/MF A01 CSCL 11/6

The deformation characteristics of two thermomechanically processed, high-magnesium, aluminum-magnesium-zirconium alloys were investigated. The processing included warm rolling at 300 C to 90 to 95% reduction. Tension testing was done at various temperatures and strain rates and superplastic elongations were observed for both alloys. Subsequently, samples of Al-10%Mg-0 .1% Zr were tested at 300 C to strains ranging from 8% to 267% as well as to fracture. Strain rates of .00667/s and .000667/s were used. These were examined via TEM to observe microstructural changes which occur during deformation. Quantitative analysis of the functional relationship between stress, strain, strain rate, and grain size for this alloy is done in an attempt to fit its deformation response to current models for superplastic deformation. GRA

N86-13415# Semicon Associates, Inc., Lexington, Ky.
A STUDY OF RHENIUM AS AN ALTERNATE SUBSTRATE MATERIAL FOR IMPREGNATED DISPENSER CATHODES Final Report, Oct. 1982 - Sep. 1983
W. L. Ohlinger and C. V. French Jul. 1985 48 p
(Contract F33615-82-C-5041)
(AD-A159113; AFWAL-TR-84-4141) Avail: NTIS HC A03/MF A01 CSCL 11/6

Rhenium powder with an average particle size of 6.8 microns was used to develop the fabrication techniques of rhenium cathodes. Pressing pressures, sintering temperatures, and sintering times were the parameters of concern. The possibility of machining unlubricated, impregnated cathodes was also tested. Electron microscopy, nitrogen permeability, and metallography methods were used to characterize the various matrices and compare them to tungsten matrices. Cathodes impregnated with 5:3:2 or 4:1:1 barium-calcium-aluminate were tested for emission performance and compared to tungsten cathodes. A guard ring structure was installed around the cathode to suppress edge effects. Results indicated that rhenium can be fabricated into a working cathode. Fabrication techniques are not completed, and optimization methods need to be studied. Results from emission testing showed 4:1:1 to be the impregnant of choice for a rhenium matrix due to little or no emission from a 5:3:2 impregnated cathode. Testing also proved that activation procedures must be altered according to the metal used. Recommendations for methods of emission enhancement and future studies were made. GRA

N86-13416# Oak Ridge National Lab., Tenn.
COMBINED SMALL ANGLE X-RAY SCATTERING AND TRANSMISSION ELECTRON MICROSCOPY STUDIES OF Al-Li ALLOYS
S. Spooner, D. B. Williams, and C. M. Sung 1985 15 p Presented at the 3rd Intern. Aluminum-Lithium Conf., Oxfordshire, England, 9 Jul. 1985 Prepared in cooperation with Lehigh Univ., Bethlehem, Pa.
(DE85-016356; CONF-850777-2) Avail: NTIS HC A02/MF A01

Combined small angle X-ray scattering (SAXS) and transmission electron microscopy (TEM) studies have been performed on two binary Al-Li alloys subjected to different pre-aging treatments. Both the SAXS and TEM data indicate that delta (Al3Li) in samples of the two alloys directly quenched to the aging temperature is larger in size than in samples quenched to below room temperature prior to aging. SAXS data indicate an initial rise in scattering center size in Al-9.4 at. % Li, or in the TEM stsudies of delta' in both alloys. It is considered that these observations are evidence that the initial rise in the SAXS data in Al-9.4 at. % Li alloys is due to a phenomenon other than delta' precipitation. The possibility of matrix spinodal decomposiiton in this alloy is one explanation. DOE

N86-13417# Los Alamos National Lab., N. Mex.
HIGH STRAIN RATE DEFORMATION IN FCC METALS AND ALLOYS
P. S. Follansbee 1985 34 p Presented at EXPLOMET '85 - Intern. Conf. on Met. Appl. of Shock Wave and High Strain-Rate Phenomena, Portland, Oreg., 28 Jul. 1985
(Contract W-7405-eng-36)
(DE85-017533; LA-UR-85-3026; CONF-850770-8) Avail: NTIS HC A03/MF A01

The effort of strain rate, and particularly of high strain rates, on deformation mechanisms in materials is of fundamental interest to those who model and analyze dynamic loading. In many materials the strain rate sensitivity is known to increase dramatically when the strain rate is raised above approx. 1000 s(-1). This increase has been interpreted previously as a transmission in deformation mechanism from thermal activation control at low strain rate to dislocation drag control at high strain rate. In copper, copper-aluminum alloys and stainless steel, recent measurements have shown that the increased rate sensitivity found at high strain rates is not due to a transition in deformation mechanism but rather can be explained with standard thermal activation theory. These findings and their implications regarding the formulation of constitutive behavior are presented. DOE

N86-13418# Los Alamos National Lab., N. Mex.
THRESHOLD STRESS MEASUREMENTS IN SHOCK-DEFORMED COPPER
P. S. Follansbee and G. T. Gray 1985 19 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter., Spokane, 22 Jul. 1985
(Contract W-7405-eng-36)
(DE85-014076; LA-UR-85-2251; CONF-850736-11) Avail: NTIS HC A02/MF A01

The height and shape of the obstacle profile for the dominant obstacle provide information on the nature of the deformed microstructure. These quantities can be measured on recovered shock-deformed material. Purpose of this paper is to investigate shock wave deformation mechanisms by measuring the mechanical threshold, or threshold stress, on shock deformed material. Oxygen-free-electronic (OFE) copper was selected for this study since its shock-deformation behavior has been extensively studied and since these shock-deformation results complement extensive measurements at strain rates up to 10 to the 4th power/sec. Measurements of the mechanical threshold, their implications regarding deformation mechanisms and correlations with the microstructure characterized with TEM are described in this paper. DOE

N86-13419# Los Alamos National Lab., N. Mex.
MUON SPIN RELAXATION STUDY OF EXCHANGE COUPLING IN DILUTE AgMn ALLOYS
R. H. Heffner, D. W. Cooke, R. L. Hutson, M. E. Schillaci, S. A. Dodds, G. A. Gist, and D. E. MacLaughlin 1985 9 p refs Presented at the Intern. Conf. on Magnetism, San Francisco, 26 Aug. 1985 Prepared in cooperation with California Univ., Riverside and Rice Univ., Houston, Tex.
(Contract W-7405-eng-36)
(DE85-014104; LA-UR-85-2106; CONF-850890-1) Avail: NTIS HC A02/MF A01

We have observed for the first time conduction-electron mediated muon-impurity coupling, and deduced the strength of the conduction electron-Mn exchange coupling. Our results are marginally consistent with a wave-vector dependent exchange model. DOE

N86-13420# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Section Materiaux.
CHARACTERIZATION OF 7017 ALUMINUM ALLOYS IN THICK PROFILES, IN THE METALLURGICAL VERSIONS T6510, T76510 AND T736510, TEST REPORT NO. PV-44-607/F [ALLIAGES D'ALUMINIUM 7010: GROS PROFILES, ETATS METALLURGIQUES T6510 - T76510 - T736510, PROCES VERBAL NO. 44-607/F]
Y. Barbaux 30 Jan. 1985 85 p In FRENCH
(Contract STPA-82-96-025)
(PV-44-607/F) Avail: NTIS HC A05/MF A01

Tests to study the feasibility of the substitution of 7X75 alloy molded pieces for aeronautical use by 7010 alloy extruded thick profiles were performed. The results confirm a gain in static characteristics, a good level of toughness and an acceptable performance in crack growth and fatigue. The two first versions are equivalent to the T736510 alloy except for higher static characteristics. Author (ESA)

N86-13421# Centre d'Essais Aeronautique Toulouse (France). Lab. d'Etudes de Materiaux Metalliques.
EVALUATION OF THE TITANIUM IMI 829 ALLOY PRODUCED BY POWDER METALLURGY Test Report [EVALUATION DE L'ALLIAGE DE TITANE IMI 829 ELABORE PAR METALLURGIE DES POUDRES (PROCEDE PSV DU CENG)]
1985 105 p In FRENCH
(M1-610200) Avail: NTIS HC A06/MF A01

A high temperature titanium alloy, (550C) was tested using two grain sizes and two hot isostatic pressures. The static and fatigue properties were measured. The results show elongation, and tensile strength 35% lower than forged material. The fatigue results are also clearly poorer than those of forged material. Author (ESA)

N86-13422# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MATERIALS SCIENCE AND METALLURGY
29 Jul. 1985 80 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UMS-85-006) Avail: NTIS HC A05

Progress is reported in U.S.S.R. Materials Science and Metallurgy. Topics discussed include: aluminum and its alloys; amorphous alloys; beryllium; protective coatings; composite materials; corrosion; energy effects; ferrous metallurgy; glass and ceramics; magnesium; powder metallurgy; steels; thin films; superhard materials; titanium and welding. For individual titles, see N86-13423 through N86-13494.

N86-13423# Joint Publications Research Service, Arlington, Va.
HEREDITARY EFFECT OF DENDRITE LIQUATION OF TITANIUM AND ZIRCONIUM ON STRUCTURE AND PROPERTIES OF ALUMINUM ALLOYS Abstract Only
I. N. Fridlyander, O. A. Setyukov, and N. V. Ruchyeva *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 1 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 5, May 1985 p 43-45 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Increasing the amount of titanium in an aluminum alloy is known to produce a finer structure and eliminate fan like structure, but as titanium content nears the limit permitted by standards, some coarseness may also result. The present article discusses chemical and structural features of dendrite formations in the alloy Dl6ch and V95pch. Content of copper, manganese and titanium, as determined by micro-X-ray spectral analysis, showed Dl6ch to have 1.3 to 2.0% Co and about 1% Ti in central zones, and in dark cells from 2 to 3.6% Co. Other tests with alloys containing 5.0% zinc, 2.5% manganese and 1.8% copper, and varying amounts of titanium and zirconium showed that in zones with coarse structure, Ti content exceeded the normal amounts by 6 to 8 times, while zirconium was found in 1.5 to 2 times the normal amount for the alloy. Increasing smelting temperature of the alloy had little effect. Interdendrite liquation was not eliminated by any of the procedures tested. Author

N86-13424# Joint Publications Research Service, Arlington, Va.
FIBER COMPOSITION MATERIALS FOR STRENGTHENING COMPONENTS OF ALUMINUM AND ITS ALLOYS Abstract Only
V. K. Gribovskiy, I. Kh. Chutayev, A. G. Bakayev, and A. Ye. Azarenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UM-85-006) 29 Jul. 1985 p 1-2 Transl. into ENGLISH from Tekhnol. i Organ. Proizv. (Kiev), no. 3, Jul. - Sep. 1984 p 53-54 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Local strengthening is a promising method for increasing the useful life of portions of machinery that are subjected to particularly severe wear conditions. The present article summarizes attempts to improve the wear characteristics of diesel engine compression rings and ring seats. Work at the Central Institute for Diesel Research in Leningrad has focused on plasma resmelting with simultaneous addition of new alloying materials in the compression ring seat area in order to harden and strengthen it. Attempts to add powders or monolithic fibers of stainless steel or nickel were unsuccessful, but better results were achieved with composition materials based on aluminum and containing nickel, nichrome or steel. The continuous feed system for producing such improved pistons is diagrammed and described. The fibers were improved and forging made more stable by an intermittent stretching procedure. Operational tests have indicated that piston life is increased by 1.5 to 1.7 times by this method. Author

N86-13425# Joint Publications Research Service, Arlington, Va.
STRUCTURE AND PROPERTIES OF Al-Mg-Zn CASTING ALLOYS Abstract Only
N. A. Parkhomenko, N. S. Gerchikova, V. V. Cherkasov, and P. P. Pobezhimov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 2 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 3, Mar. 1985 p 56-57 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Diffraction electron microscopy was used to study the fine structure of casting alloys in the system Al-Mg-Zn as a function of alloying and heat treatment conditions. Analysis of mechanical test data for the alloys established certain regularities: as magnesium content increases, strength increases but ductility decreases. The optimal combination of properties is found at Al-5.5% Mg-2.5% Zn. The major hardening phase of the alloys is the T phase (Al2Mg3Zn3) liberated at 160 to 170 C. Upon heating to 190 C or higher, the beta phase (Al3Mg2) begins to form, first at subgrain boundaries, then throughout the entire body of the grain at temperatures over 200 C. Coagulation of T phase particles and beta phase growth lead to a decrease in strength. The best combination of properties of the alloy with optimal composition corresponds to the beginning of the T yields beta phase transition, observed after aging at 80 C for 8 hours plus 190 C for two hours. Author

N86-13426# Joint Publications Research Service, Arlington, Va.
DISCONTINUOUS PRECIPITATION IN ALUMINUM-MAGNESIUM ALLOYS WITH HIGH MAGNESIUM CONTENT Abstract Only
N. N. Buynov and L. I. Kaygorodova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 3 Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Sverdlovsk), v. 59, no. 1, Jan. 1985 p 91-95 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the possibility of reducing the grain size in cast Al-Mg alloys by breakdown of a supersaturated solid solution by a discontinuous mechanism. This analysis of the literature indicates that Al-Mg alloys have a number of peculiarities which distinguish them from aluminum alloys of other systems, including slight natural aging with a recovery at low temperatures, easy breaking of bonds between magnesium atoms and vacancies, forming accumulations of vacancies; rapid development of grain boundary segregations; presence of Bardin-Haring dislocation sources; and initial coherent matrix development of metastable beta phase particles. Stresses developing in the alloy upon single phase decomposition do not reach the critical state necessary for decomposition of the supersaturated solid solution by the discontinuous mechanism. This plus the high density of phase particles segrated along grain boundaries prevent decomposition of the supersaturated solid solution during aging. Author

N86-13427# Joint Publications Research Service, Arlington, Va.
STRUCTURE FORMATION IN SILUMINS UPON RAPID CRYSTALLIZATION Abstract Only
V. I. Mazur, V. Z. Kutsova, and K. I. Uzlov *In its* USSR Rept.:

Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 3 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 3, Mar. 1985 p 50-55 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Thin films of Al-Si alloys cooled from the liquid state at 10 to the 5th power-10 to the 6th power deg c/s were stored at -196 to +20 C and their structure and phase composition subsequently studied. Droplets of melt were catapulted to a copper drum rotating at 2000 rpm, melt temperature 1100 C. The structure of the alloys was studied by light and electron transmission microscopy. The phase composition was determined at -196 to +20 C by diffractometry. Where the silicon content is 12.7 to 23% with significant heating of the melt beyond the melting point, preferential interaction of dissimilar Al-Si atoms occurs. Metastable phases may be formed: cubic, orthorhombic and hexagonal phases, which break down upon cooling to stable phases, the a-solid solution and silicon. Author

N86-13428# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ALLOYING ELEMENTS AND IMPURITIES ON MECHANICAL PROPERTIES OF COMPLEX SILUMINS Abstract Only
Yu. B. Bychkov, N. A. Balanayeva, A. A. Ofengenden, and Yu. Ye. Kupershtok *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 4 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 3, Mar. 1985 p 57-59 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study is made of the influence of alloying elements (Si, Cu, Mn, Mg) and impurities (Fe and Zn) over a broad range of concentrations on mechanical properties of Al-Si-Cu alloys in the cast state. The work was performed by passive experimentation with alloys containing 4 to 10% Si, 0.5 to 5% Cu, 0.5 to 0.9% Fe, 0.2 to 0.8% Mn, 0 to 3% Mg and 0.5 to 2.4% Zn. Mechanical properties of the alloys were determined using the individually cast specimens, with five parallel measurements of all properties for each melt. The equations are derived to describe the variation of yield point and ultimate tensile strength as a function of content of the various elements. It is found that as zinc concentration increases, short term tensile strength of the alloys increases slightly, yield point still more. Increasing copper concentration significantly increases tensile strength, yield point and hardness, while elongation decreases. At lower concentrations, silicon decreases tensile strength, increasing it at higher concentrations. Iron decreases the positive influence of silicon on tensile strength. Zinc partially compensates the influence of copper on short term strength. Magnesium increases tensile strength at contents of less than 1.6%. Author

N86-13429# Joint Publications Research Service, Arlington, Va.
STUDY OF FRACTURES IN CAST PARTS OF HIGH-STRENGTH ALUMINUM ALLOY Abstract Only
E. A. Lalayan, R. M. Brodskaya, and V. S. Zolotarev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 4-5 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 3, Mar. 1985 p 60-62 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Results are presented from studies on the quality of cast parts made by counterpressure casting of high strength aluminum alloy AMKh-605, and Al-Cu-Mn-Cr alloys (5.6 to 6.4% Cu, 0.25 to 0.55% Mn, 0.20 to 0.55% Cr, 0.20 to 0.45% Ti, 0.08 to 0.25% Zr, < or = 0.25% Fe, < or = 0.25% Si, < or = 0.05% Mg). Chill castings were heat treated by quenching from 450 C (20 hours) in water, aging at 160 C for five hours with cooling in air. Fractograms of tensile specimens are presented. Scanning electron microscopy allows an ambiguous determination of the cause of failure of a part, be it at initial crystallization crack defects or burns, and also allows a relationship to be established between structure and mechanical properties. Author

N86-13430# Joint Publications Research Service, Arlington, Va.
STUDY OF PERMEABILITY OF TWO-PHASE ZONE IN ALUMINUM AND COPPER ALLOYS Abstract Only
N. Yu. Kolyadina, Yu. Ye. Matveyev, and V. T. Borisov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 5 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Chernaya Met. (Moscow), no. 1, Jan. 1985 p 4-6 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study is made of permeability in alloys such as silumin (Al-6% Si-0.3% Mg; Al-4% Cu) and tin bronze (Cu-10% Sn; Cu-15% Sn). The method for determining permeability coefficient was based on measurement and analysis of attenuation of twisting oscillations of a terroidal specimen of the alloy in the solid-liquid state. The alloy was crystallized or melted at a predetermined rate, which varied between 0.5 and 4.5 C/min. At a fixed temperature determining the cross section of the liquid phase and dendritic structure of the two phase zone, the specimen was twisted with an elastic filament along the axis of the torus and allowed to oscillate, the amplitude of the oscillations being measured at fixed time intervals. The change in coefficient of permeability and cross section of two phase zone is shown to be similar over the solidification temperature interval. The more rapidly the alloy was crystallized or melted, the less the coefficient of permeability.
Author

N86-13431# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF DEGREE OF DEFORMATION ON STRUCTURE AND PROPERTIES OF NATURALLY AGED ALLOY 1163 Abstract Only
L. N. Leshchiner, S. I. Kishkina, and N. S. Gerchikova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 6 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, Feb. 1985 p 61-62 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the influence of deformation of rolled products on the properties of naturally aged aluminum alloy 1163 (type D16ch) with reduced content of iron and silicon (4.3% Cu, 1.4% Mg, 0.43% Mn, 0.12% Fe, 0.05% Si). Plates 6 to 8 mm thick were cut from hardened, straightened and naturally aged slabs and rolled at normal temperature with 7, 11, 15, 20 and 25% deformation. The plates were straightened by stretching after rolling with residual deformation of about 1% to produce a flat surface. The properties of the specimens were determined in extension, the work of fracture of a specimen with a crack and low cycle fatigue properties were determined, and the dislocation structure was studied by diffraction electron microscopy. Rolling deformation over 7% was found to lead to a decrease in fracture toughness. After 11 to 15% deformation, the increase in strength properties is greater than after 7% deformation, with the same ductility and fracture toughness, homogeneous distribution of dislocations and low cycle fatigue properties no less than in the initial, naturally aged state. Author

N86-13432# Joint Publications Research Service, Arlington, Va.
APPEARANCE OF SUPERPLASTICITY EFFECT IN ALUMINUM ALLOYS WITH LITHIUM Abstract Only
I. N. Fridlyander, Ye. V. Ekhina, T. M. Kunyavskaya, and V. L. Likin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 6-7 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, Feb. 1985 p 62-63 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the influence of lithium content on the superplasticity characteristics of aluminum alloys containing 5.8 to 6.2% Mg, 1.7 to 2.55% Li, 0.1% Cr, and 0.1% Fe. Ingots 70 mm in diameter were cast in a water-cooled mold, then bars 18 mm in diameter were produced by direct pressing at 400 to 420 C. Temperature-speed tests of specimens of the alloys studied in extension were performed on a test device with a tubular electric furnace. The favorable influence of lithium on the characteristics of superplasticity of the aluminum alloys was found to result from

a decrease in grain size and an increase in diffusion processes along grain boundaries. The superplasticity effect appears in alloys containing over 2% Li. Author

N86-13433# Joint Publications Research Service, Arlington, Va.
PRELIMINARY ANNEALING ON CRYSTALLIZATION OF AMORPHOUS Fe80Si6B14 ALLOY Abstract Only
Yu. A. Skakov, V. L. Kozhevnikova, and P. Reykh *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 8 Transl. into ENGLISH from Izv. Vyssh. Ucehb.: Chernaya Met. (Moscow), no. 1, Jan. 1985 p 152 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The purpose of this work was to study the influence of preliminary low temperature treatment on crystallization of the amorphous alloy Fe80Si6B14 by X-ray methods. The alloy was produced in the amorphous state by cooling in the liquid state as a strip 10 mm wide and about 50 micrometer thick. Cooled specimens were subjected to isothermal annealing at 250, 300 and 350 C, holding one hour. The specimens were then held from 30 minutes to 2.5 hours at the crystallization point of the alloy (430 C). A 2 micrometer thick layer was removed by electrolytic polishing from either side of the specimens after heat treatment. Analysis of the specimens showed no significant differences from results obtained in the initial specimens. This indicates that stabilization of the amorphous matrix has a volumetric nature, i.e., is not related to changes in the state of the surface or redistribution of zonal stresses. Author

N86-13434# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF CHROMIUM ON CRYSTALLIZATION OF AMORPHOUS Fe-B ALLOYS Abstract Only
S. D. Kaloshkin, A. K. Zaytsev, T. Yu. Mochalova, B. V. Molotilov, V. P. Ovcharov, and I. A. Timilin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 8-9 Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Sverdlovsk), v. 59, no. 1, Jan. 1985 p 165-170 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The purpose of this work was to determine the parameters of crystallization (temperature, heats and effective energies of activation) of amorphous iron-boron alloys containing chromium. Compositions studied included: Fe85(-x)Cr(x)B15 (where x-0, 2, 5, 10, 15 and 18 at.%) and Fe90(-y)Cr10B(y) (where y-12, 14, 15 and 18 at.%). Specimens were obtained by cooling a melt on a spinning drum as a strip 1 to 2 mm wide and about 20 micrometer thick. Studies were performed with a scanning microcalorimeter with continuous heating at 2, 4, 8, 16 and 32 per minute. The increase in thermal stability of amorphous iron-boron alloys observed upon addition of chromium is related to the following factors: chromium prevents diffusion flow of boron away from locations of future iron-based solid solution crystals; the addition of chromium decreases the heat of crystallization; chromium may influence the initial structure of the amorphous alloys. Author

N86-13435# Joint Publications Research Service, Arlington, Va.
RELATIONSHIP OF THERMAL EXPANSION OF AMORPHOUS METAL ALLOYS WITH THEIR HIGH TEMPERATURE PLASTIC PROPERTIES Abstract Only
V. A. Khonik, A. N. Konopkin, and V. A. Zelenskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 9 Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Sverdlovsk), v. 59, no. 1, Jan. 1985 p 204-205 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The amorphous metal alloys Pd77.5Cu6Si16.5 and Co70Fe5Si15B10 studied were obtained by quenching from the liquid state. The specimens were 30 to 50 micrometer thick and 0.7 to 1.5 mm wide. Data on thermoexpansion and differential scanning calorimetry are presented. The specimens were heated at 0.07 K/s to an assigned temperature, then deformation was immediately begun at 3.5 x 10 to the minus 2 power mm/s. Study of thermal expansion can reveal amorphous metal alloys which may be superplastic. Manifestation of the superplasticity effect in these alloys requires a crystallization of the material not begun before the glass point is reached. Maximum plasticity is found in amorphous metal alloys in which the interval between the crystallization point and the glass point is broadest. Author

N86-13436# Joint Publications Research Service, Arlington, Va.
ON ANISOTROPY OF MEAN ELECTRICAL RESISTANCE OF BERYLLIUM Abstract Only
G. Ye. Pletenetskiy and G. S. Koshkarev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 10 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Metal. (Moscow), no. 2, Mar. - Apr. 1985 p 60-61 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Data on mean electrical resistance (MER) of beryllium monocrystals and its temperature dependency in previous research have been contradictory. The present article reports on study of MER anisotropy in monocrystals of 99.99 and 99.6% purity in a broad temperature range from 4.2 to 1535 K. Results showed that in a cryogenic range, anisotropy grew rapidly as temperature increased and was not related to impurity content. In a medium range of 273 to 1023 K, a more complex pattern emerged, where impurities brought some increase in anisotropy, while at higher temperatures it declined as the state of impurities changed. Author

N86-13437# Joint Publications Research Service, Arlington, Va.
COMPLEX NICKEL-ALUMINIDE COATINGS ON NICKEL-CHROMIUM ALLOY EP648-VI Abstract Only
L. A. Monakhova, E. M. Lazarev, V. N. Novilov, B. M. Zakharov, A. B. Varigin, L. A. Lapidovskaya, and K. I. Dikaya *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 11 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Metal. (Moscow), no. 2, Mar. - Apr. 1985 p 157-160 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Studies have shown that oxidation of high chromium content Ni-Cr alloys at temperatures above 1000 C is governed by gas acquisition and evaporation of alloying elements from the metal, leading to improvement of the chromium and resultant intercrystalline corrosion and loss of temper. The present article reports on study of the structure of the alloy EP648-VI with various coatings after oxidation at 1150 C for 24 hours. Coatings were applied by gasothermal spraying and vacuum diffusion calorization. After the thermal treatment, samples were examined metallographically to show that oxygen acquisition and chromium loss were in balance. X-ray phase and electronographic analyses showed that the coatings applied by plasma spraying contained the intermetallide Ni3Al as the basic phase, with a spinel cinder, while coatings applied by diffusion calorization had both NiAl and Ni3Al intermetallides in the coating, and cinders of alpha-Al2O3 and spinel. The sub-zone of spinel that formed prevented oxygen penetration and protected the alloy from loss of chromium and subsequent deterioration. Thus, processes that provide such an impenetrable zone are an important part of such coated alloys. Author

N86-13438# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF Co-Cr-Al-Y COATINGS ON PHYSICAL AND MECHANICAL PROPERTIES OF EI-893 STEEL IN GT-100 TURBINE DRIVE VANES Abstract Only
B. A. Movchan, I. S. Malashenko, V. I. Nikitin, A. I. Runikov, Yu. P. Belolipetskiy, A. M. Klytsina, A. Ye. Levin, Yu. D. Sklyarov, N. P. Vashchilo, K. Yu. Yakovchuk et al *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 12 Transl. into ENGLISH from Probl. Spets. Elektrometal. (Kiev), no. 1, Jan. - Mar. 1985 p 34-41 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Coatings of Co-Cr-Al-Y produced by vacuum precipitation were used to protect the drive vanes of a high-pressured peak load gas turbine. Coatings containing 21 to 23% Cr, 11 to 12% Al and up to 0.1% Y were obtained by precipitation in a vacuum in an electron beam evaporator. The vanes were made of deformed

heat resistant EI-893VD nickel alloy. After application of the protective layer the parts were subjected to standard heat treatment and shot peening, followed by 2-stage aging under standard conditions. The diffusion layer consisted mainly of (Ni, Co)Al intermetallides and of carbide particles, microhardness 4200 to 4600 MPa, 900 to 1000 MPa higher than the base metal. Optical and electron microscopy revealed that there were no significant changes in the structure or phase composition of the base metal. Laboratory testing revealed that the coatings reliably protected the nickel alloys under static stress conditions at 800 and 850 C in gas turbine fuel ash and air. Additional aging increased the corrosion durability of the coatings. Fatigue strength was satisfactory under normal operating conditions. Author

N86-13439# Joint Publications Research Service, Arlington, Va.
ELECTRIFICATION OF FILLED POLYETHYLENE COATINGS IN FRICTION WITH METAL Abstract Only c27
V. S. Mironov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 12-13 Transl. into ENGLISH from Vestsi Akad. Nauk BSSR (Minsk), no. 1, Jan. - Mar. 1985 p 38-42 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study is presented of the influence of the electrophysical nature and concentration of dispersed filler in polyethylene coatings on the degree and kinetics of relaxation of the charge arising upon friction of the coatings with metal. Repeated experiments established that polyethylene coatings in friction with metal are charged negatively. When a filler is included in high density polyethylene the polarity of the charge of the material remains negative. Electron microscope studies of the surface of filled high density polyethylene coatings showed that friction, as a result of deformation and wear, slightly changes the shape of particles of nickel and teflon and teflon in thin surface layers, the particles remaining separated by intermediate layers of the polymer while graphite particles are spread over the polymer surface, increasing the surface electric conductivity of composite coatings containing graphite. This causes charge dissipation to dominate over charge growth in graphite-filled coatings. Other fillers may increase the electric charge and residual charge. Author

N86-13440# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF TEXTURE OF TITANIUM NITRIDE COATINGS ON WEAR RESISTANCE OF CUTTING TOOLS Abstract Only
G. L. Platonov and V. N. Anikin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 13 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Feb. 1985 p 40-43 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The type of texture obtained or the influence on the operational properties of hard alloy tools with textured coatings are discussed. Flat plates of VK6, T5K10 and TT10K8B hard alloys, onto which coatings of titanium nitride were applied from a gas phase consisting of a mixture of titanium tetrachloride and nitrogen in a current of hydrogen at 900 to 1150 C were studied. Textures appeared regardless of metal substrate at 1050 C and continued through 1150 C. The type of texture in all cases was axial, varying with base alloy and precipitation temperatures. It is indicated that in titanium nitride coatings precipitated under the experimental conditions, axial growth textures, both monaxial and biaxial, are formed on the plates. DOE

N86-13441# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ANNEALING ON HARDNESS OF VACUUM-DIFFUSION CHROMIUM COATING ON LOW-CARBON STEEL Abstract Only
N. Ye. Yanenskiy, P. I. Melnik, A. V. Galyko, B. N. Nadvornyy, A. S. Stetsenko, and V. N. Yanenskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 14 Transl. into ENGLISH from Tekhnol. i Organ. Proizv. (Kiev), no. 4, Oct. - Dec. 1984 p 35-36 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The possibility to increase hardness and wear resistance of vacuum-diffusion chromium coatings on type VSt3ps steel was studied. Specimens 25 mm in diameter and 30 mm high were vacuum chrome plated to a layer thickness of 1.2 to 1.4 mm, with an alpha solid solution of chromium in iron with a transition layer 40 to 50 micron thick at the substrate consisting of a chrome eutectoid. The microhardness of the alpha solution was 180 to 220 kgf/sq mm, of the eutectoid - 240 kgf/sq mm. Specimens were then annealed at 950 and 1050 C for 3 to 5 hours. Sections were cut from the annealed specimens to study the structure, distribution of carbide-forming elements and microhardness. Analysis of the data showed that increasing time and temperature of annealing increased microhardness of the vacuum chrome-plated layer by a factor of 1.5 to 2 while simultaneously increasing the thickness of the hardened layer. The eutectoid sublayer completely disappears in this process. E.A.K.

N86-13442# Joint Publications Research Service, Arlington, Va.
STUDY OF PROPERTIES OF GAS-THERMAL COATINGS OF COMPOSITE NICHROME-ALUMINUM ALLOY POWDERS Abstract Only
Yu. S. Borisov, M. G. Zolotogorov, I. N. Gorbatov, V. R. Kalinovskiy, V. A. Paschchenko, Z. A. Zaytseva, and N. N. Kokorina *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 15 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1984 p 50-52 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The heat resistance, thermal stability and bond strength of atomized coatings of composite powders containing nichrome and an aluminum alloy with yttrium or lanthanum was studied. It was found that introduction of 0.1% Y leads to formation upon oxidation at 1000 to 1200 C of a finely dispersed scale resistant to thermal shock and having good adhesion to the base. The optimal content of binder and drying conditions were established. The optimal binder content was found to be 1.5 to 3%. Testing of thermal stability showed that the coatings containing rare earth metals began to break down significantly after 200 cycles, whereas coatings made of composite powders containing aluminum E.A.K.

N86-13443# Joint Publications Research Service, Arlington, Va.
EFFECT OF GEOMETRY OF FIBER PACKING ON CONSOLIDATION OF FIBROUS COMPOSITION MATERIALS WITH POROUS MATRIX Abstract Only c24
B. A. Arefyev, L. A. Bondarchuk, T. I. Pavlova, I. I. Renne, V. L. Tikhmyanov, and V. K. Ushakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 16 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Mater. (Moscow), no. 2, Mar. - Apr. 1985 p 127-130 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Production of fibrous composition materials (FCM) by solid phase consolidation of a porous matrix is hampered by unevenness. Analysis of the nature of such consolidation with a hexagonal packing with varying vertical and horizontal spacing is reported. A mathematical model of a porous matrix and absolutely stiff fibers is presented. It is indicated that a hexagonal packing form with alpha = square root of 3 is the best parameter for horizontal spacing of fibers. Reducing the initial porosity of the matrix made it possible to reduce irregularities in the density of the FMC material, especially where relative fiber content is very high. E.A.K.

N86-13444# Joint Publications Research Service, Arlington, Va.
CONDUCTIVITY OF METAL-CERAMIC MULTILAYER ZrO2-Mo AND Mo-BASED COMPOSITE MATERIALS Abstract Only c24
S. M. Kats, Z. I. Bylkova, V. N. Bogin, A. P. Filichkin, and N. G. Chubenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 16 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Feb. 1984 p 61-64 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The possibility to increase heat conductivity of multilayer composites through the layers by replacing the purely oxide layers with cermets consisting of a homogeneous mixture of ZrO2 and

Mo was studied. The specimens were disks 50 mm in diameter and 2 to 3 mm thick, sintered of stacks of plasticized sheet films produced from CaO-stabilized finely milled ZrO2 powder and Mo powder. It is shown that varying the content of the metal-ceramic phase can significantly alter heat conductivity from 20 to 100 W/m.k while retaining the strength and thermal stability of oxide materials. E.A.K.

N86-13445# Joint Publications Research Service, Arlington, Va.
PRODUCTION OF MULTILAYER MAGNETIC SURFACE OF MAGNETICALLY SOFT COMPOSITE MATERIALS Abstract Only c24
A. E. Ritso, O. A. Katrus, A. A. Laansoo, and R. A. Siymar *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 17 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Feb. 1985 p 70-73 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The direct rolling of powders is used to produce a substrate at least 0.4 mm thick capable of operating at high frequencies and providing a magnetic induction of at least 0.9 T1 with reduced remagnetization losses with a field intensity of 5000 A/m. The ferromagnetic component used was iron powder, obtained by a chemical-metallurgical method. After rolling, the plates were heat-treated in air. The magnetically soft composite material with epoxy resin was treated at 160 C, the material with ethyl silicate at 550 C. Plates of minimum thickness and maximum density were obtained from the composite material with epoxy resin. The method of rolling produces substrates 0.35 to 0.4 mm thick with magnetic induction 1.02 and 1.35 T1 at 5000 and 10,000 A/m. It is found that magnetic circuits of composite materials with silica differ little from circuits made of substrates with epoxy resin for magnetic characteristics. E.A.K.

N86-13446# Joint Publications Research Service, Arlington, Va.
CALCULATION OF DAMPING PROPERTIES OF COMPOSITE MATERIALS Abstract Only c24
V. N. Brinza, B. S. Vekshin, and Ye. V. Kolyadina *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 17 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Chernaya Met. (Moscow), no. 1, Jan. 1985 p 79-81 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The damping capability of a material consisting of a mixture of strengthening and plate-like granules exposed to a periodic load on its upper surface was studied. It is assumed that granules do not slip relative to each other, that the deformation of the material by the periodic load is elastic and homogeneous, and that the periodic load acts on the specimen at a frequency significantly different from its resonant frequency. It is demonstrated that the method developed for calculation of damping properties of fiber composite materials can be applied to estimation of the damping properties of composite materials consisting of metallic granules. The variation in damping properties of the composite material as a function of relationship of elasticity modulus oscillation decrements, mass and density of the granule materials is obtained and experimentally confirmed. The method of calculation can be used to estimate the damping properties of other composite materials as well. E.A.K.

N86-13447# Joint Publications Research Service, Arlington, Va.
THEORY OF PYROLYSIS OF COMPOSITE POLYMER MATERIALS Abstract Only c24
A. M. Grishin and S. P. Sinitsyn *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 18 Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), v. 20, no. 6, Nov. - Dec. 1984 p 67-69 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The pyrolysis of composite polymers was studied by analyzing the decomposition of the corresponding polymers. A mathematical theory of the pyrolysis of composite polymers on the basis of simplified kinetic diagrams and representations of the mechanics of the reacting media was constructed. The direct and reverse problems of pyrolysis are formulated and the direct and reverse problems are analyzed under isothermal or homothermal conditions for one and two-staged kinetics of decomposition of the binder. A method is suggested for solving the reverse problems which was tested on model examples. The influence of the error in experimental data on the solution of the reverse problem is demonstrated. The possibility is demonstrated on model to determine the thermokinetic constants of pyrolysis based on the results of experimental studies. E.A.K.

N86-13448# Joint Publications Research Service, Arlington, Va.
CRITICAL BEHAVIOR OF THERMOELECTRIC POWER IN BINARY COMPOSITE MATERIALS Abstract Only c24
A. S. Skal *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 18 Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 88, no. 2, Feb. 1985 p 516-521 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Thermoelectric power in binary random metal-metal or metal-insulator composites is considered, and its behavior as the hole concentration P1 in the conducting component approaches the threshold of an infinite cluster is analyzed on the basis of site-problem and bond-problem models for phase transitions of the second kind. For calculation of the effective Seeback coefficient in terms of the Peltier heat, its dependence on the properties of the two materials is evaluated for the two extreme cases of almost equal thermal conductivities and very different thermal conductivities. In the first case there are no active seats of thermal emf and the conducting component acts only as a shunt, while the second component in effect vanishes. In the second case electric charges and heat are conducted simultaneously when the carrier concentration is above the threshold level, with isothermal clusters breaking up fast within the critical range and the temperature of the infinite cluster tending to become a linear function of the carrier concentration. E.A.K.

N86-13449# Joint Publications Research Service, Arlington, Va.
TEMPERATURE-FREQUENCY VARIATION OF MECHANICAL LOSSES IN PERIODIC DEFORMATION OF MULTILAYER GLASS-REINFORCED PLASTICS Abstract Only c27
L. S. Yelistratova, V. V. Kolokolshikov, and A. S. Podkolayev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 19 Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Novosibirsk), no. 6, Nov. - Dec. 1984 p 139-144 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Regularities in the temperature-frequency position and magnitude of the maximum of loss angle tangent and real portion of Young's modulus in multilayer composites were studied. The equations are illustrated with numerical computations of frequency-dependent elastic and damping characteristics of multilayer glass and carbon fiber-reinforced composites in the area of transition of the matrix from vitreous to highly elastic states. E.A.K.

N86-13450# Joint Publications Research Service, Arlington, Va.
CORROSION RESISTANCE OF DIFFUSION AND GALVANIC COATINGS ON STEEL FASTENERS Abstract Only
B. F. Soldatov, Ye. N. Shavlovskiy, N. I. Kaporik, M. Ye. Belitskiy, and A. P. Epik *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 20 Transl. into ENGLISH from Tekhnol. i Organ. Proizv. (Kiev), no. 4, Oct. - Dec. 1984 p 43 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The possibility and economic expediency of replacing galvanic coatings on steel fasteners with diffusion coatings which have similar corrosion resistance were studied. Fasteners of type St. 3 steel with M4 thread 13 mm long were tested following diffusion chrome plating, chromo-aluminizing, aluminizing and zinc coating in powder mixtures consisting of the saturating element, an activator and a neutral diluting agent. Thickness of the diffusion layers produced was 20 to 40 micrometers. In corrosion testing, corrosion occurred with all coatings in all corrosive media, diffusion

coatings produced after chrome plating chromo-aluminizing being most corrosion resistant. Nickel and chrome galvanic coatings can be replaced with diffusion chromo-aluminized coatings on products that must meet certain esthetic requirements, or chromium diffusion coatings if esthetics are not as important. E.A.K.

N86-13451# Joint Publications Research Service, Arlington, Va.
ANTICORROSION POLYMER PACKING FILM WITH IMPROVED PROTECTIVE PROPERTIES Abstract Only c27
N. I. Domantsevich, O. N. Kopyl, and A. N. Tynnyy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 20 Transl. into ENGLISH from Tekhnol. i Organ. Proizv. (Kiev), no. 4, Oct. - Dec. 1984 p 37-39 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A conservation and packaging material was created, type IPP inhibited polymer film, which combines the processes of conservation and packaging of metal products while it significantly improves labor conditions. The IPP is a transparent polymer film based on low-intensity polyethylene modified during extrusion by the addition of a finely dispersed powder of dicyclohexylamine nitrite (DAN) corrosion inhibitor. Vacuum shrink wrapping of motor vehicle metal parts in the film is recommended. High-density polyethylene was used with hexamethyleneimine metanitrobenzoate as the corrosion inhibitor. The new film is superior to IPP in its protective properties, broad temperature interval at which it can be processed and relative cheapness. E.A.K.

N86-13452# Joint Publications Research Service, Arlington, Va.
EXTREMELY HIGH REFLECTIVE CAPABILITY OF ZIRCONIUM BURNING IN AIR UNDER EFFECTS OF CONSTANT CO2 LASER RADIATION Abstract Only c36
O. G. Buzykin, A. V. Burmistrov, M. N. Kogan, V. I. Konov, A. M. Prokhorov, and V. G. Ralchenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 22 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 4, Apr. 1983 p 779-782 Original language document was announced in IAA as A85-35470 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

It is shown experimentally that in the case of nonisothermal laser ignition of Zr in air, the oxinitride is located in the outer scale layer and determines the reflectivity. The possible mechanisms of formation of the nitride phase on the specimen surface as a result of rapid combustion and transition to a gas-phase-limited reaction are examined. Some previously proposed models describing changes in the reflectivity of Zr and Ti during ignition without allowance for the formation of nitrides are discussed. V.L. (IAA)

N86-13453# Joint Publications Research Service, Arlington, Va.
MECHANICAL LASER CUTTING OF METALS Abstract Only
B. S. Gavryushenko, L. V. Okorokov, N. N. Rykalin, I. Yu. Smurov, A. A. Uglov, and A. P. Khalboshin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 23 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Mater. (Moscow), no. 2, Mar. - Apr. 1985 p 4-7 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The advantages of laser heating which are precise focus and localization, simplicity, maneuverability and stability are outlined. Mechanical laser cutting procedures which use a laser device are diagrammed and described. Cutting with laser heating is compared to cold cutting with analogous conditions. Instrument wear, power features of the cutting process and the quality of the final product are compared. It is indicated that at 1.0 KWT of power, the useful life of the cutting edge quadruples, to 8 minutes. E.A.K.

N86-13454# Joint Publications Research Service, Arlington, Va.
CERTAIN FEATURES OF LASER DESTRUCTION AND DISLOCATIONAL STRUCTURE OF SILICON DURING HEATING AND EFFECTS OF ELECTRICAL FIELD Abstract Only c36
M. S. Bakharev, A. A. Gorbachev, L. I. Mirkin, a. S. Mokh, and R. R. Sheverdova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 23-24 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Mater. (Moscow), no. 2, Mar. - Apr. 1985 p 37-40 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The effects of laser processing on silicon monocrystals, comparing properties before irradiation and after gamma-ray laser processing, polishing and annealing for 1.5 hours at 950 C in a vacuum oven are reported. The GOR-100 laser's intensity was varied by focus adjustments. A nearly circular dense zone was found at the site of laser treatment. The dislocational changes in structure were the only variations noted before the melting point, despite the brittleness of pure silicon. After melting, an electrical current transmitted through the silicon resulted in arc-like cracks. Most damage was to the surface. Structural distortions have a semispherical form with 1 to 2 mm diameter and 30-50 mcm depth. Temperature effects are noted in the dislocational structure of the silicon samples. E.A.K.

N86-13455# Joint Publications Research Service, Arlington, Va.
STRUCTURE OF FLOW OF EROSION PLASMA FORMED UPON LASER TREATMENT OF METALS Abstract Only c75
L. Ya. Minko, B. T. Fedyushin, Yu. A. Chivel, and A. N. Chumakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 24 Transl. into ENGLISH from Kvatovaya Elektron. (Moscow), v. 12, no. 3, Mar. 1985 p 639-640 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

In metals which are exposed to a laser beam the erosion plasma of the target material has a structured nature like the flow of gas behind the subsonic radiation wave in air. The structure of the flow is observed before and after development of shielding of the laser radiation. Flat specimens of aluminum, zinc and bismuth were exposed to a microsecond Nd laser beam with an energy of almost 40 J. A ruby laser beam with a pulse duration of about 30 ms and regulated delay was used to record shadow photographs of the flame produced. The structure of the erosion plasma is thought to be purely kinetic in origin. The structure of the erosion plasma has dynamic rigidity and can be significant in the formation of the structured subsonic radiation wave in the stage of acceleration of the flame, when the heavy air plasma or air compressed by the shock wave breaks through into the lighter erosion plasma. E.A.K.

N86-13456# Joint Publications Research Service, Arlington, Va.
CERAMICS BASED ON ALUMINUM NITRIDE AND METALS Abstract Only c27
Ye. N. Bukharin, A. S. Vlasov, and A. A. Alekseyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 28 Transl. into ENGLISH from Steklo i Keram. (Moscow), no. 2 Feb. 1985 p 23-25 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The possibility of producing metal-ceramics with service temperatures up to 1000 C was investigated. The cermets were obtained by sintering of binary mixtures of aluminum nitride powder with iron, nickel, chromium, molybdenum and tungsten. The gas medium used was a mixture of nitrogen with hydrogen. Aluminum nitride-metal compositions with 20 to 75% metal were studied. Components were prepared and mixed in a planetary mill. Specimens were shaped by semidry pressing at 20-25 kPa, then sintered in a periodic furnace in the nitrogen-hydrogen mixture. Near theoretical density was obtained in mixtures containing up to 50% iron and chromium, up to 42% nickel and up to 75% molybdenum and tungsten. Hardness of the composites decreases with increasing metal content and varies with hardness of the metal used. Composites containing iron, molybdenum and tungsten have good oxidation resistance of 800 C. Composites with nickel and chromium have significantly higher oxidation resistance at up to 1200 C. Maximum oxidation of specimens containing iron, nickel and chromium at 1000 C occurs in the first 4 hours, while further holding at this temperature causes practically no additional mass change. E.A.K.

N86-13457# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SODIUM ON MECHANICAL AND CASTING PROPERTIES OF MAGNESIUM-LITHIUM ALLOYS Abstract Only
L. V. Nikulin, A. Ye. Gayevskiy, and L. K. Dodrova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 29 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Tsvetnaya Met. (USSR), no. 6, Nov. - Dec. 1984 p 79-83 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The influence of sodium on the mechanical properties yielded upon crystallization under pressure and the hot shortness of binary and more complex magnesium-lithium alloys was studied. The alloying elements were selected for their influence on strength and ductility of the binary magnesium-lithium base. Mechanical properties were tested on standard specimens cut from ingots 40 mm in diameter and 80 mm high-crystallized under piston pressure 200 MPa to eliminate shrinkage porosity. An increase in content of impurity sodium was found to decrease strength and particularly ductility equally whether specimens were crystallized under high pressure or solidified in a chill mold. The presence of sodium significantly increases hot shortness. E.A.K.

N86-13458# Joint Publications Research Service, Arlington, Va.
THERMOPHYSICAL PROPERTIES OF TUNGSTEN AT HIGH TEMPERATURES Abstract Only
I. V. Seminko, A. D. Krivorotenko, and Ye. N. Fomichev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 35 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1984 p 72-75 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The production of reliable values of the enthalpy and heat capacity of tungsten, was studied in the 1200 to 2800 K temperature interval. Standard specimen of the thermodynamic properties of tungsten were formulated, which are now a part of the State Register of Measures and Measurement Instruments of the USSR, number 2458-82. E.A.K.

N86-13459# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF POROSITY OF THIN SHEETS OF FIBER MATERIALS BASED ON OPTICAL TRANSMISSION COEFFICIENT Abstract Only **c24**
A. G. Kostornov, O. V. Kirichenko, S. P. Sakhno, and G. S. Tymchik *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 35 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1984 p 86-90 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

An analysis is presented of the structure of porous fiber materials by methods of mathematical statistics and the theory of random processes. The interrelationship of porosity with the optical transmission factor of fiber materials is studied within the framework of a single probabilistic-statistical approach. The fiber material models suggested allows structural parameters to be defined as statistical characteristics. Porosity and optical transmission factor of a sheet fiber material are defined with an error of not over 6% where porosity is over 70% as functions of the geometric dimensions of fibers, diameter d and length, sheet thickness h and mean density of geometric fiber centers lambda. A function is established which allows porosity of thin sheets of fiber material to be determined by measuring the optical transmission factor.
Author

N86-13460# Joint Publications Research Service, Arlington, Va.
EFFECT OF HEATING CONDITIONS ON AGGLOMERATION OF POWDERED ALUMINUM IN AIR ATMOSPHERE Abstract Only
A. K. Likenbakh, N. A. Zaporina, A. Z. Knipele, V. V. Strod, and L. K. Lepin *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 36 Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), v. 21, no. 1, Jan. - Feb. 1985 p 73-82 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Much recent research has attempted to define the mechanism and quantity agglomeration and fusion of metals in precombustion and combustion. Factors such as the rate of temperature increase have been considered. The present article presents the results of an electron microscope study of the effect of the heating rate on oxide layer breakdown of aluminum particles as related to structure and composition of the gaseous environment. A poly-dispersed aluminum powder with particle diameters averaging 10 mcm is deposited as a coating on corundum or nichrome, then subjected to temperatures of 1173-1473K in a flow of air. The electron microscope images of the powder particles are described at temperatures in that range and heating rates of 2000 to 15,500K/min agglomeration occur without oxide layer breakdown. Thermomechanical reaction of the metal nuclei and the oxide layer and physicochemical oxidation of metals compete in the processes described. The initial state of the oxide layer and other important factors require further study. Author

N86-13461# Joint Publications Research Service, Arlington, Va.
SUPERELASTIC BEHAVIOR OF POWDERED TITANIUM NICKELIDE DURING PRESSING Abstract Only
I. F. Martynova, V. V. Skorokhod, S. M. Solonin, and G. R. Fridman *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 36 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Feb. 1985 p 13-17 Original language document was announced in IAA as A85-28751 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The dilatation of TiNi powder during compaction due to superelasticity has been investigated experimentally using X-ray diffraction analysis. It is shown that dilatation occurs in several stages including a significant increase in volume directly after compaction, a slight increase in volume during subsequent heating. It is also shown that the maximum volume recovery does not reach 100 percent and that the extent of volume recovery decreases as the degree of compaction increases. The dilatation effect becomes more pronounced with increasing temperature and porosity. Author

N86-13462# Joint Publications Research Service, Arlington, Va.
GRAIN GROWTH IN HEAT-RESISTANT AUSTENITIC STEEL Abstract Only
I. K. Denisova, V. N. Zakharov, N. M. Karpova, and V. M. Farber *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 38 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, Feb. 1985 p 54-56 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study is made of the kinetics of grain grown in type 37Kh12N8G8 steel alloyed with V, Nb, Ti, and Mo and W. The steel is produced in an arc furnace, ingots vacuum molded, subjected to homogenization annealing at 1050C for 8 hr, and forged into 15 x 15 mm bars at 900-1180C. Specimens cut from the bars are heated in a salt bath to 1150, 1200, or 1250C, held 1.5 hours and quenched in water. It is found that the nature of the carbide phase and kinetics of its dissolution in heat-resistant austenitic steels define the tendency of the steel toward grain growth. A decrease in diffusion mobility at atoms in the steel matrix caused by alloying with titanium and tungsten leads to significant decreases in the tendency toward grain growth and grain size variation. Author

N86-13463# Joint Publications Research Service, Arlington, Va.
EFFECT OF ELASTOPLASTIC CYCLIC DEFORMATION ON MECHANICAL CHARACTERISTICS OF STEEL O3Kh13AG19 AT TEMPERATURES OF 293 AND 77 DEG K Abstract Only
V. A. Strizhalo, I. I. Medved, V. V. Suptelya, and L. N. Demidenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 39 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 4, Apr. 1985 p 36-39 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Unstable mechanical loads may occur as short-term overloads

that reach or exceed the yield point of given construction materials. The present article reports on a study of the effects of deformation under such overloads on durability and plasticity of alloys made by cryogenic technology. Cyclic loading and subsequent failure are determined for cylindrical samples of O3Kh13ag19 steel with an electromechanical device adapted to place controlled loads and maintain the temperatures of 273 and 77 K. Since low-temperature tensoresistors are impractical under the given parameters, special extensometers and clock-type indicators are substituted. Results indicate that significant changes occur in the deformation diagram, particularly in the zone of elastic-to-plastic transition. Preliminary elastoplastic deformation reduces the material's ability to endure deformation strengthening and increases the likelihood of brittle failure. Temperature reduction has no qualitative effect. Author

N86-13464# Joint Publications Research Service, Arlington, Va.
SPECIFICS OF THE PROCESS OF FAILURE OF STRUCTURAL STEELS STRENGTHENED BY THERMO-MECHANICAL WORKING WITH DEFORMATION IN THE INTERCRITICAL TEMPERATURE INTERVAL Abstract Only
M. L. Bernshteyn, P. D. Odeskiy, and T. M. Gryunvald *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 39-40 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Chernaya Met. (Moscow), no. 1, Jan. 1985 p 85-90 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study is made of the specifics of failure of rolled materials after hardening working by thermomechanical treatment with deformation in the intercritical temperature interval and subsequent high tempering, achieving a tensile strength of at least 500 MPa with exceptional cold shortness. The study is performed on type 15G2SF steel, composition: 0.16% C, 1.45% Mn, 0.60% Si, 0.09% V, 0.006% S, 0.016% P. Treatment consists of austenitization at 930C for 20 minutes with subsequent cooling to the temperature of the middle of the intercrystalline interval and holding at this temperature for one hour with subsequent deformation by rolling with 50% compression in one pass. Studies are performed on nontempered specimens and also after low- and high-temperature tempering at 250 and 650C for one hour. The excellent cold shortness is found to be provided by creation of a specific substructure consisting of large subgrains within which there are much smaller subgrains and by the presence of splits. The specific substructures result from dynamic recrystallization in place, the split from the strong texture formed in thermomechanical treatment. Author

N86-13465# Joint Publications Research Service, Arlington, Va.
MECHANICAL PROPERTIES OF EP794 STEEL + 12Kh18N10T STEEL BIMETAL Abstract Only
V. A. Borisenko and M. G. Parfenov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 40 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 4, Apr. 1985 p 18-19 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The mechanical properties and structure of a bimetal obtained by explosive welding of a cladding layer of EP794 steel 11 mm thick to a base layer of 12Kh18N10T steel 20 mm thick are studied. Specimens are tested in the initial state and after various types of heat treatment including tempering, annealing, and hardening. The joint is a wavy boundary with deformed, smaller grains on both sides. Melted areas have a characteristic column structure with shrinkage cracks in some inclusions. Annealing at 850C causes recrystallization and coagulation of the carbide phase. Hardening from 1050 C results in the formation of carbides along the deformation texture at the grain boundaries. The bimetal has optimal mechanical properties in its initial state and after hardening. Heat treatment may be required after welding, forging, etc. Author

N86-13466# Joint Publications Research Service, Arlington, Va.
MACRO- AND MICROFRACTOGRAPHIC SPECIFICS OF DISSIPATED IMPACT RUPTURE OF TYPE 45 STEEL IN THE VISCOUS-BRITTLE TRANSITION INTERVAL Abstract Only
L. R. Botvina and G. V. Klevtsov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 41 Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, Feb. 1985 p 27-29 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The specifics of dissipated rupture at the viscous-brittle transition temperature interval of type 45 steel with a microstructure are studied after annealing at 900C consisting of alternating areas of ferrite and perlite, the apparent cause of its dissipated failure. Impact testing of prismatic specimens with V-shaped stress concentrator is conducted on a swinging hammer at temperatures from 180C to -196C with quantitative macrofractographic analysis performed on an optical microscope and comparator, and microfractographic analysis performed on a type JSM-U3 scanning microscope. X-ray structural analysis of the state of the materials near the fracture surfaces in their central portion is performed on an X-ray diffractometer in cobalt K sub alpha radiation. The studies allowed tracing of the regularities of dissipated fracture in the viscous-brittle transition interval of temperatures. At temperatures of 130C the entire fracture has a fibrous structure. At 90-130C dissipated failure occurs with areas of viscous and brittle fracture in the center of the fracture. At 90 to -196C the fracture is entirely brittle, with a zone of stable crack growth seen in microfractographic analysis at the tip of the notch, indicating that the fracture is concentrated. Author

N86-13467# Joint Publications Research Service, Arlington, Va.
DURABILITY OF STEEL 45 WITH BORIDE COATING IN CORROSIVE-ABRASIVE MEDIA Abstract Only
V. V. Kozub, V. M. Golubets, and M. I. Pashechko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 41-42 Transl. into ENGLISH from Fiz.-Khim. Mekhan. Mater. (Kiev), v. 21, no. 2, Mar. - Apr. 1985 p 118-120 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The effect of a corrosive-abrasive medium on the durability of steel 45 with a boride coating is reported. Samples are tested under roller-bushing conditions at relative creep rates of 0.4, 0.6 and 0.8 m/sec, pressure of 1-5 MPa and 30 minutes duration. Introduction of KOH or HCl gives pH ranging from 12 to 1. Results show that with 2-3 MPa load durability increases, while with higher pressure it decreases. The friction surfaces show microscratches and bright worn spots after creep. In further testing the pores of the boride coating are additionally plated with nickel to prevent corrosion. Wear increases thereafter in correlation to pressure. Corrosive-abrasive media are judged to reduce surface hardness and thus cause accelerated wear in steel 45. Values of 7.4 and 12 pH are not accompanied by changes in the boride coating's properties. Author

N86-13468# Joint Publications Research Service, Arlington, Va.
DISPERSION HARDENING OF HIGH-STRENGTH NiOCo-Mo STEELS Abstract Only
A. g. Rakhshtadt, A. V. Kan, O. M. Khovova, M. D. Perkas, and a. F. Yedneral *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 42 Transl. itno ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 5, May 1985 p 33-37 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Secondary hardening with emission of special carbides and formation of alloyed martensite is accompanied by a sharp brittle change, which can be partially avoided by careful choice of alloying components. The system Fe-Ni-Mo, in which the Fe-Ni martensite matrix undergoes less embrittlement and less carbon content is found . Molybdenum is the agent causing the secondary hardening. The carbide formed dissolves in austenite starting at 1000C, the alloy retaining plasticity and viscosity. The test steel, which contains 0.3% carbon, is alloyed with 6% molybdenum and, in various samples, 5, 10 and 15% Co. Results show that at 1100-1150C, there is sufficient dissolution of excess phases with preservation of the fine-grain structure. After tempering at 1150 C up to 25% residual austenite remains; processing in liquid nitrogen reduces

that percentage. Mechanical tests show that the Fe-Ni martensite retains high plasticity with increased durability. The alloy contains a high degree of saturated alpha-solid solution, thus facilitating its use as a matrix phase for supplemental tempering. Optimum cobalt content is 10%. Author

N86-13469# Joint Publications Research Service, Arlington, Va.
MODELING OF THERMAL FATIGUE AND EROSION OF COMPLEX ALLOYED STEELS IN METAL MELTS Abstract Only
Yu. A. Glukhov and A. D. Abramov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 43 Transl. into ENGLISH from Fiz.-Khim. Mekhan. Mater. (Kiev), v. 20, no. 6, Nov. - Dec. 1984 p 12-15 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Several programs are presented for structural elements cyclically interacting with metal melts for experimental estimation of the corrosion durability of structural elements used in liquid metals. A schematic plan of erosion is studied, including fatigue damage to the element cyclically interacting with the melt, the accumulation of fatigue damage in the surface layers of the structural element being determined by the entire complex of adsorption-diffusion effects, chemical and hydrodynamic desorption in the process of repeated cyclical loading of the cross section by contact with the liquid metal. As an example, conditions of testing of hollow circular and smooth continuous specimens in torsion in a melt are analyzed. The durability of steels under the test condition reaches a maximum at quite different hardening temperatures. Erosion on a base of 15,000 cycles is minimal in the interval of very high hardening temperatures, 1370-1420K. Nitriding and cyaniding of type 4Kh5MFS steel are studied for their influence on erosion resistance in liquid metals. It is found that at less than 2000 cycles the rate of erosion of treated specimens is less than for structurally homogeneous specimens. It then increases rapidly, so that at 3000 cycles due to the development of a system of fatigue cracks erosion of the metal from the surface is much more rapid than for untreated metals.
Author

N86-13470# Joint Publications Research Service, Arlington, Va.
STUDY OF EFFECT OF NORMAL REACTOR WATER ON GROWTH RATE OF FATIGUE CRACKS IN 15Kh2NMFA STEEL Abstract Only
V. I. Pokhmurskiy, A. S. Zubehcnko, A. A. Popov, I. P. Gnyp, v. M. Timonin, I. Z. Dutsiak, and I. N. Antoshchak *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 43-44 Transl. into ENGLISH from Fiz.-Khim. Mekhan. Mater. (Kiev), v. 21, no. 2, Mar. - Apr. 1985 p 32-34 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

High temperature water reduces steel's durability; this factor has recently received more attention by engineers working with pressure systems. To test the steel under conditions approaching normal use, a laboratory autoclave is designed to test pressures up to 18 MPa at water temperature of 350C. The growth of fatigue cracks is measured in compact samples of 25 mm thickness during thermal processing. The device makes it possible to replicate a symmetrical triangular loading pattern; loads are applied in a range of 6.8-11 mHz, with constant temperature control in a sealed chamber. The relationship between the kinetic diagram of fatigue failure and the rate of fatigue crack growth is discussed. Results show less fatigue cracking at lower coefficients of stress intensity, and a correlation as that coefficient and the rate of cracking increases. Further refinement of the methods used is recommended. Author

N86-13471# Joint Publications Research Service, Arlington, Va.
SUPERHARD MATERIALS DEVELOPED Abstract Only
V. Bibikov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 45-46 Transl. into ENGLISH from Sov. Belorussiya (Minsk), 14 Jun. 1985 p 2 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Scientists of the Belorussian Academy of Sciences' Institute of Solid-State and Semiconductor Physics have developed two new superhard materials. Their properties surpass those of their previous counterparts by a substantial measure. The first innovation comes in the form of round black tablets for making cutters, reamers and other metalworking tools. The new tools can operate continuously for 4-6 hours. This is 4-6 times as long as tools made of superhard cubic boron nitride, which was developed at the same institute. The second superhard material developed equals natural diamond in hardness at only a fraction of its cost. It will be used in bits for drilling deep and superdeep boreholes as well as in tools for machining nonferrous metals. In the latter case, the surface of the part becomes almost as smooth as a surface that has been polished. Author

N86-13472# Joint Publications Research Service, Arlington, Va.
MICROMECHANISMS OF ELECTRODIFFUSION FAILURES IN THIN FILM METALLIZATION Abstract Only
V. N. Solovyev, V. F. Sinkevich, and G. A. Dyadyna *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 47 Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 55, no. 2, Feb. 1985 p 348-353 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A microscopic approach is suggested for the construction of models explaining the kinetic properties resulting from the influence of grain boundaries in which without concrete specification of the model of the polycrystal it is possible to produce activation characteristics of a film. The reasons for non-zero divergence of the ion stream are investigated. Processes of particle transfer in disordered media are studied and the influence of dimensional effects of the electric transfer of ions in thin films is discussed. This literature analysis indicates that the activation energy of migration of Al in polycrystalline films varies between 0.3 and 1.2 eV as a function of the structure of the grain and method of production of the film. E sub alpha varies greatly as a function of the structural irregularities in the films. In textured films as well as films with bamboo structure, transfer processes are essentially blocked. Introduction of impurities such as Cu, O2, Mg and Si to films slows the processes of electrodiffusion. Diffusion of amorphous films, particularly at high temperatures, leads to slowing of electrotransfer processes. Author

N86-13473# Joint Publications Research Service, Arlington, Va.
ION NITRIDING OF TITANIUM
D. A. Prokoshkin, T. A. Panayoti, and G. V. Solovyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 48-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. MV I SSO SSR: Mashinostr. (Moscow), no. 5, May 1985 p 107-110 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The effect of various ion nitriding process factors (temperature, duration, pressure, composition of the gaseous medium) on the structure, phase composition, and properties of diffusion layers is studied. It is shown that nitrogen pressure in the chamber has a significant effect on diffusion zone thickness, a relationship which has an extreme nature, and that a nitrided titanium layer of greatest thickness can be achieved in a mixture of nitrogen diluted with argon. It is established that an adequate diffusion layer depth can be attained in titanium VT1-0 with short holding periods and relatively low temperatures. Ion nitriding increases the wear resistance of titanium VT1-0. The effectiveness of using a glow discharge to accelerate the process of gas nitriding titanium is established. Author

N86-13474# Joint Publications Research Service, Arlington, Va.
CALCULATION OF FAILURE CONSTANT FOR TITANIUM ALLOYS Abstract Only
A. G. Bochvar *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 53 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 2, Mar. - Apr. 1985 p 154-156 Original language document was announced in IAA as A85-31523 (For primary document see N86-13422 04-26)

Avail: NTIS HC A05

In an earlier study, a fracture constant, Delta, equal to the squared ratio the theoretical shear and rupture strengths, has been proposed. Here, an attempt is made to determine the value of Delta for pure titanium, commercially pure titanium, and commercial titanium alloys. It is found that for alpha, alpha+beta, and beta titanium alloys, the fracture constant Delta depends only slightly on the chemical composition and structure of the alloy. Thus, at room temperature, Delta varies from 0.10 (for VT9 alloy) to 0.13-0.14 (for pure and commercially pure titanium). For engineering calculations, Delta can be assumed to equal 0.12. Author

N86-13475# Joint Publications Research Service, Arlington, Va.
SUBCRITICAL CRACK DEVELOPMENT UNDER CONSTANT LOAD IN VT6 ALLOY Abstract Only
A. V. Fishgoyt, B. A. Kolachev, and V. A. Grinberg *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 53 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 4, Apr. 1985 p 74-79 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Cracking of titanium alloys under constant loads limits their use in construction. The nature of this cracking using VT6 alloy with 6.0% Al and 4.5% V forged in the beta zone with minor deformation in the alpha + beta zone and retaining a platelet structure is described. Samples 125 x 120 x 50 mm are cut, and either immediately annealed at 1023 K or hydrogenated before annealing. Part of the hydrogenated samples are placed under load by insertion of a wedge in a slit for 3 months. The coefficient of stress intensity is measured at the beginning and end of the tests, and the development of the slit is determined microscopically and by ultrasound methods. Results indicate that subcritical cracking is found only in materials subjected to plane deformation. A model relating elements sensitive to deformation to the coefficiency of stress intensity (CSI) is formulated to show the correlation between cracking sites and growth in the CSI. The linear nature of this phenomenon and its connection with hydrogen damage is shown mathematically. As hydrogen diffuses in the crack surface, where great expansion tension is present, a continuing cracking process takes place. A catastrophic decline in impact resistance occurs in the VT6 alloy when hydrogen concentration reaches 0.12% of weight. Author

N86-13476# Joint Publications Research Service, Arlington, Va.
SILICIDE COATINGS FOR PROTECTING TITANIUM-NIOBIUM ALLOYS FROM HIGH-TEMPERATURE OXIDATION Abstract Only
E. M. Lazarev and Z. I. Kornilova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 54 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Mater. (Moscow), no. 2, Mar. - Apr. 1985 p 96-98 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Titanium-niobium alloys have high durability, corrosion resistance, and heat durability, but low wear values and a tendency to stick. A study of silicide coatings with a surface film of nearly pure SiO2 is described. Heat resistance of the test material is studied at 1100C in alloys with 30-50% niobium, showing severe oxidation and formation of slag after 15 hours. The alloys are then coated with silicide by solid-phase diffusion. Electronographic and X-ray study shows the diffusion layer to consist of TiSi2, NbSi2, Ti5Si3 or Nb5Si3. Oxidation and defects in the coating are studied further. Results show that the silicide coatings reduce the rate of oxidation markedly. Increasing the length of oxidation to 25 hours leads to some resorption of the coating. Micro-X-ray spectral analysis shows that near the alloy-slag boundary the titanium alloy undergoes enrichment due to thermodiffusion mobility and high negative free energy of the oxide. Deep oxygen penetration leads to precipitation of fine needles, probably composed of titanium oxides. Author

N86-13477# Joint Publications Research Service, Arlington, Va.
EFFECT OF COMPOSITION OF RAREFIED MEDIUM ON GAS-SATURATED TITANIUM ALLOYS Abstract Only
V. N. Fedirko and M. N. Zima *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 55 Transl. into ENGLISH from Fiz.-Khim. Mekhan. Mater. (Kiev), v. 21, no. 2, Mar. - Apr. 1985 p 124-126 Original language document was announced in IAA as A85-35865 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

High-temperature treatment of titanium alloys in a rarefied medium can lead to the saturation of the surface of the alloys by interstitial impurities, such as hydrogen, nitrogen, carbon, and oxygen. In order to estimate the effect of various components of the rarefied medium on the gas saturation and the state of the surface of titanium alloys, experiments were conducted on VT1-0 titanium, VT5-1 and PT-7M alpha alloys, 0T4-1 and VT20 pseudo-alpha alloys, VT3-1, VT23, and VT22 alpha+beta alloys, and VT32 pseudo-beta alloy. It is shown that during the treatment of titanium alloys in a vacuum of 0.0133 Pa at 1023 K, residual air and carbon dioxide (the inevitable components of a rarefied atmosphere) affect the intensity of gas saturation to a much greater extent than do oil vapors. IAA

N86-13478# Joint Publications Research Service, Arlington, Va.
HOMOGENIZATION OF BETA-SOLID SOLUTION UPON RAPID HEATING OF TWO-PHASE TITANIUM ALLOYS Abstract Only
V. N. Grudnev, A. F. Zhuravlav, B. F. Zhuravlev, O. M. Ivasishin, and P. Ye. Markovskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 55-56 Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Sverdlovsk), v. 59, no. 1, Jan. 1985 p 152-159 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

High temperature beta phase homogenization during rapid heating is studied in a Ti-Mo alloy by mathematical simulation and experimental observation. The method used allows quantitative estimation of the influence of the two major factors determining development of the process of homogenization of the beta solid solution: heating rate and initial structure dispersion. Successive quenching of specimens from increasing temperatures in the beta area provides a simple and reliable method of observing the process of homogenization. This method allows experimental development of equations similar to those calculated for the beta solid solution area with minimum alloying element content. The experimental and calculated results are similar for a heating rate of 300 K per second. Heating rate and initial structure dispersion are found to be quite significant in the Ti-10% Mo alloy studied. A method was suggested for estimating the concentration state of improverished sectors of the beta solid solution in commercial alloys during rapid heating and used to analyze the influence of heating rates and initial structure dispersion on the process of homogenization. Author

N86-13479# Joint Publications Research Service, Arlington, Va.
CHANGES IN STRUCTURE AND MECHANICAL PROPERTIES OF NIOBIUM-TITANIUM ALLOY DURING OXYGEN SATURATION Abstract Only
Ye. M. Lyutyy, L. I. Gomozov, and O. I. Yeliseyeva *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 56-57 Transl. into ENGLISH from Fiz.-Khim. Mekhan. Mater. (Kiev), v. 21, no. 2, Mar. - Apr. 1985 p 122-124 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Factors of internal and external oxidation remain present in alloys of niobium and titanium despite the improvements brought by this combination. The effect of absorption of oxygen from the atmosphere on durability and plasticity of such an alloy with additional aluminum, zirconium, chromium and molybdenum are discussed. Plasticity of flat samples, measured by the angle of deviation, showed that as temperature increased from 700 to 1200 C the short-term tension strength of the alloy dropped sharply, from 550 to 20 MPa. Oxygen was also introduced internally with a slag oxygen source. An oxide phase formed after rapid cooling with needle-like structure. Granule boundaries were judged to be the location of most precipitate formation. With slow cooling

(at 5 K/min instead of 50 K/min), spherical precipitates formed instead of the needle-shaped particles. All the mineral components of the alloy except chromium and molybdenum were found in the oxides that formed. Author

N86-13480# Joint Publications Research Service, Arlington, Va.
INTERNAL FRICTION IN TiNiCu ALLOY Abstract Only
Yu. N. Vyunenko and V. A. Likhachev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 57 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Isvetnaya MEt. (USSR), no. 6, Nov. - Dec. 1984 p 83-86 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Results are described from measurments of the logarithmic oscillation decrement in an alloy with 50 At.% Ti + 45 At.% Ni + 5 At.% Cu, annealed for one hour at 800 C. The oscillation decrement was determined by the method of freely attenuating oscillations of a torsional pendulum at 45 Hz using cylindrical specimens with a gauge section 15 mm high, 10 mm in diameter. In some tests the metal was held at constant temperature, in others continuously heated or cooled at 2-3 C/min. It was found that TiNiCu was close in its dissipative properties to a TiNi intermetallide in terms of internal friction. No detailed study of the nature of attenuation of oscillations in TiNiCu was performed, but it is noted that apparently the change in delta in TiNiCu differs somewhat from that for TiNi. Author

N86-13481# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ELECTRON-BEAM HEATING ON STRUCTURE AND PHASE COMPOSITION OF VT9 ALLOY Abstract Only
A. A. Shipko, I. L. Pobol, G. Ye. Gorelik, and A. Ye. Korolev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 58 Transl. into ENGLISH from Vestsi Akad. Nauk BSSR (Minsk), no. 1, Jan. - Mar. 1985 p 24-28 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the structure and phase transformations occurring in the surface layer of titanium alloy VT9 when it is heated by an electron beam. The specimens were worked on an electron-beam welding machine modernized for electron beam surface hardening. The temperature field of the specimen was determined by calculation considering the parameters characteristic for the specific heating conditions. It was found that hot-formed state results in the formation of a beta-transformed structure with controlled grain size varying through the thickness of the part. This allows the level of the mechanical characteristics to be changed during heat treatment. The phase composition of the hardened layer is characterized by the presence of small needle martensite and a residual alpha phase, the relative content of which is redistributed with a change in heating temperature.
Author

N86-13482# Joint Publications Research Service, Arlington, Va.
STRUCTURE AND INTERNAL FRICTION OF NEAR-EUTECTIC ALLOY SYSTEM Ti-W TEMPERED FROM A LIQUID STATE Abstract Only
F. N. Tavadze, O. Sh. Okrostsvaridze, G. Sh. Darsavelidze, and G. F. Tavadze *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 58-59 Transl. into ENGLISH from Metallov. i Term. Obrabotka Metal. (Moscow), no. 5, May 1985 p 45-48 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Results of study of the structure and temperature dependence of internal friction (TDIF) of a near-eutectic Ti-W alloy system obtained from a liquid state at a cooling rate of about 10 degrees/second are presented. The internal friction of the needle-like structure, with thickness of 50-100 mcm and length of 5-10 mm, was measured in a vacuum relaxator with a direct torsion registration at 1 Hz in a temperature range of 20-750 C. Electronographic analysis of the resulting structure showed several highly deformed phases, resulting from the high density of structural defects and high concentrations of additive atoms. There were many voids, microdoubles and defects of formation as well as traces of gases and other impurities. The unstable phase maxima are attributed to processes taking place within or at the boundaries of the phases included in the alloy during rapid cooling. Thus in the range of 380-500 C, the saturated boron solid solution disintegrated in the alpha-titanium. Further study of these phenomena is recommended. Author

N86-13483# Joint Publications Research Service, Arlington, Va.
POSSIBLE MECHANISM OF WAVE FORMATION DURING DETONATION WELDING Abstract Only **c37**
S. V. Bazdenko, V. F. Demichev, D. Kh. Morozov, and O. P. Pogutse *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006-) 29 Jul. 1985 p 60 Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), v. 21, no. 1, Jan. - Feb. 1985 p 130-137 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

In detonation and magnetic impulse welding, the most durable products result when wave formation occurs on the surface. Various studies have disagreed on theoretical models for this phenomenon. A hypothesis that states that a certain distance behind the contact point, there is a very narrow zone where viscosity drops sharply is discussed. Theoretical and experimental data are compared that show differences between magnetic impulse and detonation welding. A suppressed flow in the viscous parallel current behind the contact point is attributed to diffusion processes. The effect of thermal conductivity was discounted in considering results, which indicated that liquid viscosity was related to the suppressed flow during contact between two currents of liquid, and cumulative factors were the key to the effectiveness of penetration of the speed rotor through the liquid flow. The long submerged flow was unstable in terms of symmetrical and asymmetrical modes of oscillation. The gradual increase in wavelength was attributed to the transition from weak initial heating to rapid heating, with an accompanying change in the flow speed. Author

N86-13484# Joint Publications Research Service, Arlington, Va.
OPTIMIZATION OF TECHNOLOGICAL PARAMETERS OF COLD PRESSURE WELDING OF AD1M THIN ALUMINUM SHEETS Abstract Only **c37**
V. F. Kuzin, Yu. V. Savinkin, M. N. Tsypona, Ye. A. Kozelo, and M. A. Arkhangelskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 61 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 4, Apr. 1985 p 9-11 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

In order to study the influence of tool geometry, tool surface condition, welded material thickness and degree of deformation on the quality of joints produced by cold pressure welding with minimum deformation of the material, a regression analysis was performed on data from an experiment involving cold pressure welding of thin AD1M aluminum sheets (0.3, 0.5 and 0.8 mm thick). It was found that under the experimental conditions used, the length of the welded zone was most greatly influenced by the angle of the tip of the tool used. The optimal angle is 7 degrees. Increasing friction on the contact surface causes an increase in the size of the welded zone, particularly where the tool angle is low or the material is thick. The quality of welding is influenced by the thickness of the welded material. With minimum friction on the contact surface, as thickness of the material increases, 1/S decreases. Maximum friction of the compact surface increases 1/S as the material increases, particularly where the tool angle is low. Author

N86-13485# Joint Publications Research Service, Arlington, Va.
STUDY OF PROCESS OF PORE FORMATION DURING ARGON-ARC WELDING OF ALUMINUM ALLOY 1420 Abstract Only
M. A. Abralov, R. U. Abdurakhmanov, and A. A. Abdurakhimov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 62 Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 4, Apr. 1985 p 21-26 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

The lack of a commonly accepted opinion concerning the

source and mechanism of formation of pores during welding of 1420 aluminum alloy hinders control of this defect. A study was therefore made to determine the specifics of pore formation and refine the source of porosity in argon-arc welding of the alloy. Experiments were performed on rectangular specimens 90 x 22 x 1.6 mm which were melted clear through. Butt joints were produced using two specimens of the same size. The major reason for the significant porosity of the alloy was found to be the presence of methane which is formed primarily in the surface layer of the metal. Rapid evolution of the methane mixed with hydrogen begins from the base metal in advance of the melting front and continues in the liquid metal bath. The constricted conditions for floating of gas bubbles generated near the melting zone at the root of the seam as well as continuous delivery of methane and hydrogen from the solid metal lead to the formation of a chain of large pores. Author

N86-13486# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF THERMAL CYCLE ON CHARACTERISTICS OF CYCLICAL CRACK RESISTANCE OF TITANIUM ALLOYS AND THEIR JOINTS PRODUCED BY DIFFUSION WELDING Abstract Only
E. S. karakozov, S. S. Vasilyeva, and S. V. Ivanov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 62-63 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 1, Jan. 1985 p 34-36 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Linear fracture mechanics was used to analyze the behavior of titanium alloys VT6Ch and VT16 and welded joints with defects. Specimens of VT16 were annealed to imitate the thermal cycling of diffusion welding at 860 and 960 C, while specimens of VT6Ch were heated to 800, 940 and 1050 C. The crack resistance of the material with a welded seam and imitation thermal cycle of diffusion welding was determined. The cyclical strength of welded joints in VT6Ch was found to be higher than in the base material with stress amplitudes below the yield point, probably resulting from the hardening effect of the martensitic alpha prime phase formed as a result of the beta-alpha prime transformation in the zone of plastic deformation in advance of a propagating crack during cyclical loading. Author

N86-13487# Joint Publications Research Service, Arlington, Va.
KINETICS OF DISSOLUTION OF OXIDE FILMS IN TITANIUM UPON DIFFUSION WELDING Abstract Only
V. V. Peshkov, V. P. Kholodov, and Ye. S. Vorontsov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 63 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 4, Apr. 1985 p 35-37 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the process of dissolution of oxide films in titanium and its alloys. Experiments were performed on specimens 16 mm in diameter and 2 mm thick of technically pure VT1-0 titanium and the alloys OT4 and VT6. The surface was polished, degreased and oxidized in air for 1.8-2.4 x 1000 at 773 (VT1-0), 873 (OT4) and 898 (VT6) K until a bluish oxide 6 x .01 pa air pressure simultaneously, separated by a titanium foil washer 0.1 mm thick to prevent contact between the surfaces. The thickness of the oxide film was measured after heating to determine the amount of dissolved oxide layer. A basic difference was established in the kinetic curves for technically pure titanium and titanium alloyed with aluminum. In technically pure titanium, the curve indicates decrease in the rate of the process as time passes, while in the alloys with aluminum there is a clear bend in the curve, which appears to be combination of two parabolas. Author

N86-13488# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF PRELIMINARY ANNEALING ON STRUCTURE AND PROPERTIES OF VT23 ALLOY WELDED JOINTS AFTER HARDENING Abstract Only
V. S. Lyasotskaya, F. R. Kulikov, N. Yu. Ravdonikas, and Ye. K. Feoktistova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 63-64 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 4, Apr. 1985 p 16-18 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Results are presented from a study of the influence of preliminary annealing before hardening on the structure and properties of welded joints in VT23 alloy made by argon-arc welding with type SPT-2 welding wire. Hot-rolled plates 30 mm thick were welded, then heated at 800 C for one hour, cooled in air and aged at 500 C for ten hours. Preliminary annealing was performed at 775 to 875 C for one hour with cooling with the furnace before hardening heat treatment, farming larger alpha plates and a smaller number of crystalline structure effects than when a lower heating temperature was used. The combination of preliminary annealing at 850 C plus standard hardening increases ductility, impact toughness and homogeneity of mechanical properties of welded joints in the alloy in comparison to similar heat treatment but without annealing. Author

N86-13489# Joint Publications Research Service, Arlington, Va.
CORROSION RESISTANCE OF WELDED JOINTS IN CERTAIN TITANIUM ALLOYS Abstract Only
G. M. Shelenkov, V. E. Troyanovskiy, V. Ye. Blashchuk, and L. M. Onopriyenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 64 Transl. into ENGLISH from AVtomat. Svarka (Kiev), no. 4, Apr. 1985 p 19-20 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study of the corrosion resistance of welded joints in technical titanium VT1-0 and low alloy titanium alloys OT4-1, PT-3 V, AT3 and AT6 was conducted. Disk-shaped specimens 30 mm in diameter and 4-6 mm thick with a circular bilateral seam 40 mm in diameter were studied. Specimens were prepared by manual argon-arc welding with a tungsten electrode, wire diameter 2 mm. Tests were performed in concentrated 99% nitric acid at the boiling point or 3030 hours. The studies showed that welded joints in titanium alloys are subjected to corrosion cracking at minimal corrosion rates. This must be considered in selecting titanium alloys as materials for the manufacture of welded structures and in corrosion testing under stress not only of alloys but also of welded joints. Author

N86-13490# Joint Publications Research Service, Arlington, Va.
DEFORMATION AND STRESSES UPON WELDING OF VT23 TITANIUM ALLOY Abstract Only
I. M. Chertov, A. S. Karpenko, A. P. Ostrovoy, V. N. Zamkov, N. A. Kushnirenko, and V. F. Topolskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 65 Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 2, Feb. 1985 p 41-43 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Results are presented from experiments studying full longitudinal deformations and residual stresses in welded joints in VT23 alloy. But joints in plates measuring 250 x 200 x 6 mm made by argon arc welding with a tungsten electrode and FAn-1 flux were studied. Welding was performed in two passes without finishing of the edges from one side. No welding wire was used. Two methods of heat treatment were used: annealing at 750 C, 1-2 hours with cooling in air and subsequent two-stage aging at 380 C, eight hours plus 550 C, two hours; annealing of individual parts before welding, then aging of the welded joint. Residual longitudinal elongation deformations were produced by welding rather than shortening, resulting from phase transformations upon cooling in the 750-550 C temperature interval. Heat treatment of welded joints consisting of annealing and aging or aging alone leads to complete relief of residual stresses, which may amount to 30% of the tensile strength of the base metal. Author

N86-13491# Joint Publications Research Service, Arlington, Va.
DETERMINING LOCAL HEATING PARAMETERS FOR INCREASING FATIGUE RESISTANCE OF WELDED JOINTS Abstract Only c39
V. N. Maksimovich, A. A. Chabanenko, P. P. Mikheyev, O. I.

Gushcha, and Yu. F. Kudryavtsev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 65-66 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 4, Apr. 1985 p 32-36 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

Artificial means of imposing beneficial residual compression tension in concentration zones have been used to increase the bearing strength of metal designs that are subject to varying load conditions. Gas heating has been used effectively to counteract stretching under load. A theoretical determination based on thermoplasticity of optimum parameters for strengthening laminates when the heat is applied to a relatively small section of the test metal and heating is by convection at a temperature that can be described by a Hauss distribution is discussed. The temperature field and the tension generated are regarded as constants. The most common methods of final differences and final elements were rejected in favor of integral-differential equations to show thermoplasticity. Various forms of statistical treatment are presented. They indicate that the effect of external load leads to changes in the fields of applied residual tension. An inverse relationship was noted; it was more pronounced with biaxial stretch. Maximum residual tension was obtained at 400-500 C. Within usual limits for fatigue of welded joints, reduction of residual compression tension did not exceed 30% of initial values. Author

N86-13492# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF STRUCTURE OF HEAT-RESISTANT NICKEL ALLOY ZhS6U ON ITS WELDABILITY IN THE SOLID STATE Abstract Only
V. N. Golubev, F. Sh. Sharifyanov, and A. V. Vlasova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) p 66 Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 2, Feb. 1985 p 13-16 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the influence of various structural characteristics of heat-resistant alloys and the phenomenon of superplasticity on the formation of a welded joint by diffusion welding. Studies were performed on heat resistant alloy ZhS6U in the cast state and the same alloy obtained from granules by powder metallurgy. Tests were performed in the 960-1200 C temperature interval at deformation rates .0001 to .1 1/s and showed significant differences in mechanical properties of the alloys obtained by different methods, related to the structural state of the alloy. The cast alloy has low ductility and high resistance to plastic deformation, whereas the powder metallurgy product shows all the signs of superplasticity at 1050-1150 C. The structure formed upon heating to the welding point has decisive influence on the weldability of heat-resistant nickel alloys. The best-quality welded joint is obtained under temperature and speed conditions corresponding to the range of superplastic deformation of the alloy. Author

N86-13493# Joint Publications Research Service, Arlington, Va.
DIFFUSION WELDING OF COPPER-CHROMIUM PSEUDOALLOY WITH COPPER Abstract Only
A. P. Sysoyev, A. V. Sergeyev, and N. F. Kazakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 68 Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, Oct. 1984 p 45-47 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study is made of the possibility of diffusion welding of a Cu-Cr pseudoalloy with copper. Welding was performed on an SDVU-26 machine. Before the parts were placed in the chamber, the surfaces of the copper and alloy were cleansed of oxide film, degreased with acetone and dried with ethyl alcohol. Strength of the joints was studied as a function of temperature and time of isothermal holding. It was found that during vacuum annealing, chromium oxides appeared on the free surface of the alloy. The degree of oxidation during heating of the materials in contact was less, but the lower oxide of chromium was still formed. When welded under conditions producing the maximum joint strength, the hardness of the alloy dropped from 140 to 97 HRB, primarily as a result of annealing of the copper matrix. The hardness of the alloy can be improved by deforming the diffusion welded plates, with a degree of relative deformation of the copper component of the bimetal of 10-13% yielding best results. Author

N86-13494# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF HYDROGEN ON FORMATION OF COLD CRACKS IN SEAMS DURING WELDING OF PIPE STEEL Abstract Only
S. L. Mandelberg, S. V. Buslinskiy, and Yu. L. Bogachek *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 68-69 Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 2, Feb. 1985 p 1-5 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

A study was made of the cold crack resistance in seams of low-alloy steels welded using conditions and materials similar to those used for the production of large-diameter pipe. Double-sided, two-layered welded joints were studied in materials of three types: steels of test rolls microalloyed with vanadium and niobium, normalized steel microalloyed with vanadium, and normalized steel containing normal microalloy elements. Rolled sheets of various thicknesses characteristic for the production of pipes were used. It was found that when welded joints of these steels are allowed to cool naturally, cracks do not form, the level of concentration of diffusion hydrogen being comparatively low. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-13495*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRACTURED TOUGHNESS OF Si3N4 MEASURED WITH SHORT BAR CHEVRON-NOTCHED SPECIMENS
Jonathan A. Salem and John L. Shannon, Jr. 1985 19 p refs Presented at Basic Sci. Meeting of the Am. Ceram. Soc., Baltimore, 17-19 Nov. 1985
(NASA-TM-87153; E-2749; NAS 1.15:87153) Avail: NTIS HC A02/MF A01 CSCL 11G

The short bar chevron-notched specimen is used to measure the plane strain fracture toughness of hot pressed Si3N4. Specimen proportions and chevron-notch angle are varied, thereby varying the amount of crack extension to maximum load (upon which K sub IC is based). The measured toughness (4.68 + or - 0.19 MNm to the 3/2 power) is independent of these variations, inferring that the material has a flat crack growth resistance curve. Author

N86-13496*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ELASTIC-PLASTIC DEFORMATION OF A METAL-MATRIX COMPOSITE COUPON WITH A CENTER SLOT
Daniel Post, Robert Czarnek, Duksung Joh, Jinmyun Jo, and Yifan Guo Nov. 1985 49 p ref
(Grant NAG1-343)
(NASA-CR-178013; NAS 1.26:178013) Avail: NTIS HC A03/MF A01 CSCL 11D

A comprehensive experimental analysis of deformations of the surface of a metal-matrix specimen is reported. The specimen is a 6-ply [0 + or - 45] sub s boron-aluminum tensile coupon with a central slot. Moire interferometry is used for high-sensitivity whole-field measurements of in-plane displacements. Normal and shear strains are calculated from displacement gradients. Displacement fields are analyzed at various load levels from 15% to 95% of the failure load. Deformations of the boron fibers could be distinguished from those of the matrix. Highly localized plastic slip zones occur tangent to the ends of the slot. Shear strains and concurrent transverse compressive strains in the slip zones reach

approximately 10% and 1%, respectively. Upon unloading, elastic recovery in surrounding regions causes a reverse plastic shear strain in the slip zone of about 4%. Longitudinal normal strains on the unslotted ligament peak at the slot boundary at about 1% strain. The strain concentration factor at the end of the slot decreases with load level and the advance of plasticity. Author

N86-13497# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF CROSS-LINKING DENSITY AND THE TYPE OF CROSS LINKAGE IN POLYURETHANE ELASTOMERS
L. M. Sergeyeva, Y. S. Lipatov, and N. I. Binkevich 2 Aug. 1985 12 p Transl. into ENGLISH from mono. "Akademiya Nauk Ukrainskoy" SSR, Kiev, 1967 p 131-137
(AD-A158199; FTD-ID(RS)T-1267-84) Avail: NTIS HC A02/MF A01 CSCL 11/10

From the standpoint of synthesizing cross-linked polymers with the potentially smallest degree of defectiveness of the network, polyurethane polymers are of special interest. The purpose of this work is to study the validity of theories that make it possible to evaluate the cross-linking density based on different physical methods for polyurethane elastomers. One of the main parameters that characterize the structure of cross-linked polymer is the value of the effective cross-linking density or the mean molecular weight of the chain segment between units. The kinetic theory of elasticity and the Flory-Renner theory of swelling are the basis for determining this value. In our study, we used the methods of evaluating the cross-linking density from data about the equilibrium modulus of high elasticity and about the compression of swollen specimens in order to determine the parameter Psi of the Flory equation, which would also make it possible to make these measurements based on data about swelling. GRA

N86-13498# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
FRACTOGRAPHY OF MIXED MODE 1 - 2 FAILURE IN GRAPHITE/EPOXY AND GRAPHITE/THERMOPLASTIC UNIDIRECTIONAL COMPOSITES Final Report, Feb. - Aug. 1984
S. L. Donaldson Jun. 1985 42 p
(AF Proj. 2307)
(AD-A158852; AFWAL-TR-84-4186) Avail: NTIS HC A03/MF A01 CSCL 11/4

The notched off-axis tensile test and the notched three rail shear test were used to produce states of in-plane loading varying from pure Mode I (crack opening) to Mode II (forward shearing). The two material systems tested were Fiberite T300/1034C graphite/epoxy and Imperial Chemical Industries graphite reinforced polyetheretherketone thermoplastic composite (APC-1 PEEK). Using a scanning electron microscope, a detailed examination of the resulting fracture surfaces was conducted. Results at magnification levels of 100X and 800X are presented. Very distinct changes can be observed in each material as the load ratio changes. In addition, for a fixed mode load ratio, large differences can be seen in the matrix deformation patterns between the two material systems. Of particular interest are ductile spike formations seen in the highly shear loaded PEEK specimens. These observations provide some insight as to the increased toughness seen at higher Mode II ratios, and the increased toughness seen in the thermoplastic system. Author (GRA)

N86-13499# Oak Ridge National Lab., Tenn.
ANALYTICAL ELECTRON MICROSCOPY OF SURFACE MODIFIED CERAMICS
P. S. Sklad 1985 5 p Presented at the Joint Meeting of the Electron Microscopy Soc. of Am. and Microbeam Anal. Soc., Louisville, Ky., 5 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016309; CONF-850840-10) Avail: NTIS HC A02/MF A01

While the effects of implantation on surface sensitive properties may be measured independently, it is important to understand the microstructural evolution leading to these changes. Analytical electron microscopy provides a useful tool for characterizing the microstructures produced in terms of solute concentration profiles, second phase formation, lattice damage, crystallinity of the implanted layer, and annealing behavior. Such analyses allow correlations to be made with theoretical models, property measurements, and results of complimentary techniques. DOE

N86-13500# Oak Ridge National Lab., Tenn.
PREPARATION OF CERAMIC FIBER-CERAMIC MATRIX COMPOSITES BY A FASTER CHEMICAL VAPOR INFILTRATION PROCESS
A. J. Caputo, W. J. Lackey, and D. P. Stinton 1985 15 p refs Presented at the 5th European Conf. on CVD, Uppsala, Sweden, 17 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016402; CONF-8506171-1) Avail: NTIS HC A02/MF A01

A new, faster process was developed for the fabrication of ceramic fiber-reinforced, ceramic-matrix composites by chemical vapor infiltration. Process and equipment improvements led to the fabrication of preforms with a higher fiber content, and infiltration improvements led to reduced infiltration run times and increased infiltrated densities. These improvements have produced composites with not only higher flexural strengths but also high strain values. The high strain values have been a goal of this work. DOE

N86-13501# Midwest Research Inst., Golden, Colo.
PHOTOGRADATION STUDIES OF SILVER-BACKED POLYACRYLONITRILE (PAN) FILMS
D. M. Smith, A. R. Chugtai, C. A. Sergides, and P. Schissel Jul. 1985 12 p Presented at the SPIE Intern. Tech. Symp. on Optical and Electro-Optical Eng., San Diego, Calif., 18 Aug. 1985 Prepared in cooperation with Denver Univ., Colo.
(Contract DE-AC02-83CH-10093)
(DE85-012154; SERI/TP-255-2751; CONF-850887-11) Avail: NTIS HC A02/MF A01

Fourier transform infrared (FT-IR) reflection-absorbance (RA) measurements have been used to characterize Ag-backed polyacrylonitrile (PAN) films and to study their photodegradation. The optical constants n and k for the polymers are determined in the mid-IR region, and the dependence of RA values on polymer functionality concentration as a function of film thickness calculated. The IR-RA values are nearly linear with the concentration of functionalities for PAN films of thicknesses up to 0.1 (MU)m. Some oxidative photodegradation pathways have been proposed; with radiation of lambda greater than or equal to 250 nm, a polyimine structure is generated. A combination of 1.0% wt of Irganox 1010 and 0.5% wt of Irgastab 2002 in PAN films was found to significantly retard the photodegradation of the polymer without affecting the specularity of the PAN/Ag surface. DOE

N86-13502# Rockwell International Corp., Golden, Colo.
SOLVENT EXTRACTION OF PLUTONIUM (IV) POLYMER BY ORGANOPHOSPHOROUS COMPOUNDS
A. C. Muscatello, J. D. Navratil, and M. E. Killion 23 Mar. 1985 17 p ref Presented at the 189th Natl. Meeting of the Am. Chem. Soc., Miami, 28 Apr. 1985
(Contract DE-AC04-76DP-03533)
(DE85-013229; RFP-3802; CONF-850417-27) Avail: NTIS HC A02/MF A01

We have recently discovered bifunctional organophosphorus reagents and TOPO (trioctylphosphine oxide) extract hydrolytic plutonium (IV) polymer from 0.1 to 7.0 M nitric acid. Other extractants are not effective in the extraction of the polymer. The extraction behavior of the polymer with octylphenyl-N,N-diisobutyl carbamoylmethylphosphine oxide(OOD(IB)CMPO), both alone and mixed with TBP(tri-n-butylphosphate) and with TOPO will be discussed. In addition, the extraction behavior with DHDECMP (Dihexyl-N,N-diethyl carbamoylmethylphosphonate) will be reviewed for comparison. In general, the extraction of the polymer increases with nitric acid concentration and is second-to-third power dependent on extractant concentration. The most efficient stripping agent is 1.0 M sodium carbonate. DOE

N86-13503# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.

CERAMIC FABRIC MATERIAL TESTING
R. Chang and H. Lips Jun. 1985 226 p
(Contract DE-AC21-83MC-20110)
(DE85-013684; DOE/MC-20110/1985) Avail: NTIS HC A11/MF A01

Filter media suitable for use at tempertures greater than 550 F, employing ceramic fibers in their construction, have been under development for several years. These filter media are intended for application in advanced energy processes such as pressurized fluidized bed combustion and gasification as well as many diverse industrial processes with temperatures ranging from 600 to 1,600 F. Present techniques for evaluating ceramic filter performance involve testing in subpilot and pilot-scale facilities which are both time-consuming and expensive. In addition, no standards yet exist for ensuring that the ceramic fabrics supplied for filter use conform to specifications for uniform quality. The objective of this program was to establish rapid test methods that can be used to quantitatively assess ceramic fabrics to be used as hot gas cleaning filters. DOE

N86-13504# Department of Energy, Washington, D. C.
METHOD OF SYNTHESIZING POLYMERS FROM A SOLID ELECTROLYTE Patent Application
T. A. Skotheim, inventor (to DOE) (Brookhaven National Lab.) Filed 19 Oct. 1984 18 p
(Contract DE-AC02-76CH-00016)
(DE85-011623; US-Patent-Appl-SN-662657) Avail: NTIS HC A02/MF A01

A method of synthesizing electrically conductive polymers from a solvent-free solid polymer electrolyte is disclosed. An assembly of a substrate having an electrode thereon, a thin coating of solid electrolyte including a solution of PEO complexed with an alkali salt, and a thin transparent noble metal electrode are disposed in an evacuated chamber into which a selected monomer vapor is introduced while an electric potential is applied across the solid electrolyte to hold the thin transparent electrode at a positive potential relative to the electrode on the substrate, whereby a highly conductive polymer film is grown on the transparent electrode between it and the solid electrolyte. DOE

N86-13505# Centre Technique des Industries Mecaniques, St. Etienne (France).
EVALUATION OF THE EROSION PROTECTION OF LOW INFLAMMABILITY LIQUIDS OF THE HFC TYPE (POLYGLYCOL SOLUTIONS) Final Report [EVALUATION DU POUVOIR DE PROTECTION CONTRE L'USURE DES FLUIDES DIFFICILEMENT INFLAMMABLES DU TYPE HFC (SOLUTIONS DE POLYGLYCOL)]
A. Ridard Mar. 1985 49 p refs In FRENCH
(CETIM-12-E-13-3) Avail: NTIS HC A03/MF A01

Wear tests were peformed using nine commercial low inflammability hydraulic fluids on a Tribolub machine following the procedure normally used with mineral hydraulic oils. The results show that aqueous fluids performance is close to that of mineral oils. The temperature and viscosity effects on the protection properties are also detailed. Author (ESA)

N86-13506# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
MICROSCOPIC OBSERVATIONS AND MECHANICS ANALYSES OF LONG TERM FRACTURE IN POLYETHYLENE PIPING MATERIALS Annual Report, 1 Jan. - 31 Dec. 1984
N. Brown 1 Feb. 1985 68 p Sponsored by Gas Research Inst.
(PB85-219608; GRI-85/0037; AR-1) Avail: NTIS HC A04/MF A01 CSCL 11I

The development of short time quantitative methods for predicting the long time-low stress filure in polyethylene piping materials is discussed. The experimental approach is based on observations of the kinetics and microstructural changes associated with the initiation stage for slow crack growth under plane strain conditions. Several microscopic techniques were used to observe the microstructure of the damage zone that emanates from a notch. The kinetics of growth of the initial damage zone were measured as a function of stress, notch depth, and temperature. Author (GRA)

N86-13439# Joint Publications Research Service, Arlington, Va.
ELECTRIFICATION OF FILLED POLYETHYLENE COATINGS IN FRICTION WITH METAL Abstract Only
V. S. Mironov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 12-13 Transl. into ENGLISH from Vestsi Akad. Nauk BSSR (Minsk), no. 1, Jan. - Mar. 1985 p 38-42 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13449# Joint Publications Research Service, Arlington, Va.
TEMPERATURE-FREQUENCY VARIATION OF MECHANICAL LOSSES IN PERIODIC DEFORMATION OF MULTILAYER GLASS-REINFORCED PLASTICS Abstract Only
L. S. Yelistratova, V. V. Kolokolshikov, and A. S. Podkolayev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 19 Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Novosibirsk), no. 6, Nov. - Dec. 1984 p 139-144 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13451# Joint Publications Research Service, Arlington, Va.
ANTICORROSION POLYMER PACKING FILM WITH IMPROVED PROTECTIVE PROPERTIES Abstract Only
N. I. Domantsevich, O. N. Kopyl, and A. N. Tynnyy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 20 Transl. into ENGLISH from Tekhnol. i Organ. Proizv. (Kiev), no. 4, Oct. - Dec. 1984 p 37-39 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13456# Joint Publications Research Service, Arlington, Va.
CERAMICS BASED ON ALUMINUM NITRIDE AND METALS Abstract Only
Ye. N. Bukharin, A. S. Vlasov, and A. A. Alekseyev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 28 Transl. into ENGLISH from Steklo i Keram. (Moscow), no. 2, Feb. 1985 p 23-25 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-13507# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C.
THE 1985 AFOSR/AFRPL CHEMICAL ROCKET RESEARCH MEETING, ABSTRACTS AND AGENDA Interim Report, Mar. 1984 - Feb. 1985
Leonard H. Caveny, ed., Anthony Matuszko, ed., and Wayne E. Roe, ed. Feb. 1985 247 p Meeting held in Lancaster, Calif., 18-21 Mar. 1985
(AF Proj. 2308; AF Proj. 2307; AF Proj. 2303)
(AD-A158291; AFOSR-85-0560TR) Avail: NTIS HC A11/MF A01

Various advances in rocket propulsion technology are presented. Major topics include: energetic material combustion; thermal properties synthesis of new ingredients; combustion stability; acoustic interaction plumes; beamed energy; solar propulsion; and electrical propulsion. For individual titles, see N86-13508 through N86-13584.

N86-13508# Rockwell International Corp., Canoga Park, Calif.
ELECTROLYTIC PREPARATION OF NOVEL AZIDODINITRO COMPOUNDS Abstract Only

Milton B. Frankel and James F. Weber *In* AFOSR THE 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 10 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Future higher performance propellants will require new classes of more energetic ingredients. Polynitro- and azido-alkyl compounds either have been or are being evaluated for this purpose. Highly substituted geminal dinitro compounds (e.g., R-C(NO2)2X, where X-NO2,CH3,.F) are of particular interest, and substitution of an azido group (X-N3) will further enhance the energetics of such compounds. This results from the fact that the azide group contributes approx. 80 Kcal/mole to the compound without decreasing the O/C ratio. G.L.C.

N86-13509# Idaho Univ., Moscow.
SYNTHESIS OF DIFLUORAMINOXY-, DIFLUORAMINO- OR FLUORODIAZONIUM-CONTAINING MATERIALS Abstract Only
Jeanne M. Shreeve *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Future rocket propulsion advances require new stable high energy materials. The research is concerned with the synthesis of stable, highly oxidizing compounds which may contain, but are not limited to nitrogenfluorine bonds and the subsequent investigation of their physical and chemical properties. G.L.C.

N86-13510# North Texas State Univ., Denton. Dept. of Chemistry.
SYNTHESIS OF NEW POLYNITROPOLYHEDRANES Abstract Only
Alan P. Marchand, Suresh C. Suri, and D. Sivakumar Reddy *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The current research program centers on the synthesis of polynitropolycyclic compounds. These compounds belong to a new class of explosives and propellants. However, relatively few polynitropolycyclic compounds have thus far been reported. G.L.C.

N86-13511# Morton Thiokol, Elkton, Md.
SYNTHESIS OF HIGH NITROGEN CONTENT HETEROCYCLIC NITRAMINES AND ENERGETIC INTERNAL PLASTICIZERS Abstract Only
Rodney L. Willer and James A. Hartwell *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A considerable need exists for energetic materials which are denser and more energetic than 1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) and are thermally and hydrolytically stable. These dense, energetic materials are needed as ingredients for advanced explosives and propellant formulations that would exceed the performance of current formulations and allow future weapons systems to meet projected performance requirements. Most of the effort in this areas has focused on two classes of compounds, the polynitro caged hydrocarbons, typified by octanitrocubane, and the caged nitramine compounds, typified by compounds such as hexanitrohexaazaadamantane and hexanitrohexauzawurtzitane. Some progress has been made with both types of compounds.
Author

N86-13512# California Univ., San Diego, La Jolla. Dept. of Chemistry.
SYNTHESIS AND REACTIVITY OF UNSATURATED METAL NITROGEN COMPLEXES Abstract Only
William C. Trogler, Joseph H. Osborne, and Mary Maciejewski *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Reactions between organic azides, N3R (R = CH3,C3H5,2,6-CH3)2C6H3, o-biphenyl, SiMe3, SiPh3,CPh3, and neopentyl) and (n-C5Me5)2V lead to (Figure 1) either (n-C5Me5)2VNR or (n-C5Me5)2VN3. Mechanisms for the mode of reactivity will be presented. The nitrene complexes exhibit one unpaired electron according to bulk magnetic susceptibility measurements. At room temperature EPR spectra are observed that reveal both vanadium and nitrogen hyperfine splitting. The three dimensional structure of (n-C5Me5)2VN(2,6(CH3)2(C6H3) was established, in collaboration with Dr. A. Rheingold of the University of Delaware, by X-ray crystallography (Figure 2) and the complex exhibits a linear V-N-R group. The unsymmetrical energetic tetrazene, Ph(PhC(O)N-N-(PhC(0)Ph, was prepared in 4 steps from phenylhydrazine and its reactivity with metal reagents was examined. Group I or II metal alkyls fragment the tetrazene to PhN3 and NH2(C(0)ph) while complexes form with transition metal carbonyls. Recent chemistry obtained with unsaturated nitrogen complexes, that are derived from monosubstituted hydrazines will be discussed. Author

N86-13513# SRI International Corp., Menlo Park, Calif. Energetic Materials Program.
SYNTHESIS AND CHEMISTRY OF POLYNITROALKANES AND POLYNITROOLEFINS Abstract Only
Clifford Bedford and Robert J. Schmitt *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Research programs in energetic materials synthesis and mechanisms were hampered by the lack of general methods for synthesizing geminal dinitroslkenes and non-acidic methods for nitramine synthesis. Effort to identify and overcome these research barriers have thus far been directed toward special situations and have met with only limited success. Author

N86-13514# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
NEW SYNTHETIC TECHNIQUES FOR ADVANCED PROPELLANT INGREDIENTS: SELECTIVE TRANSFORMATIONS AND NEW STRUCTURES Abstract Only
Robert D. Chapman, Scott A. Shackelford, and John L. Andreshak *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

New chemical transformations and methods are being investigated which potentially lead to energetic target compounds with new and noval molecular structures, or which improve synthetic routes to known compounds that are currently expensive propellant luxuries. Three of four scheduled research tasks are in progress.
Author

N86-13515# Illinois Univ., Chicago. Dept. of Chemistry.
FLUOROPOLYAZIDO-ESTERS AS ENERGETIC POLYMERS Abstract Only
Robert M. Moriarty *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 2 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A method by which the energy rich azido group can be introduced into a fluorine containing polymer was studied. G.L.C.

N86-13516# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
NEW ENERGETIC POLYMERS AS BINDERS FOR PROPELLANTS Abstract Only
Mostafa A. H. Talukder and Stanley D. Morse *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p Prepared in cooperation with Dayton Univ. Research Inst., Edwards AFB, Calif. (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

New polymeric syntheses and chain modification techniques are being investigated to obtain improved mechanical properties of known energetic binders, new energetic prepolymer and binder systems, and correlations of polymeric chemical structure to physical/mechanical properties. Its approach centers on new energetic polymer syntheses via cationic polymerization or by synthetic modifications of known polymer. Author

N86-13517# Rockwell International Corp., Canoga Park, Calif.
ENERGETIC FLUORCARBONS Abstract Only
Carl J. Schack and Karl O. Christe *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The development of general methods for the synthesis of energetic fluorcarbons and their conversion to olefins and epoxides suitable for the preparation of polyethertype energetic binders is discussed. Fluorocarbons with energetic substituents offer the potential advantages of high energy, high thermal stability high density, and also low sensitivity. Author

N86-13518# Morton Thiokol, Huntsville, Ala.
CONTROL OF THE URETHANE CURE REACTION WITH SOLID, BLOCKED ISOCYANATES Abstract Only
William H. Graham, J. B. Canterberry, Inella G. Shepard, and Jerrell W. Blanks *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The problem of controlling the cure kinetics of the isocyanate/hydroxyl reaction and the formation of polyurethanes is discussed. Successful completion of the program would provide unprecidented control of the reaction; the goal would be to demonstrate an infinite potlife below a trigger temperature and a rapid, but controllable, cure above that temperature. More generally, the approach addresses the question of differences in reactivities of molecules in solution and in the solid state. Although the system selected for study involves polyurethane cure chemistry, successful demonstration of the concept would imply that other solid state compounds could be used in triggering desired reactions only above their melt temperature, thus providing temperature sensitive on-off control chemical reactions. Author

N86-13519# State Univ. of New York, Binghamton. Dept. of Chemistry.
PHYSICAL AND CHEMICAL CONSEQUENCES OF ANTIAROMATICITY IN THE BORACYCLOPENTADIENE SYSTEM Abstract Only
John J. Eisch, Sinpei Kozima, and James E. Calle *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The mode of chemical bonding between boron atoms and clusters of carbon atoms should have a fundamental importance in determining the macroscopic physical and chemical properties of the resulting organoboron compounds. The stability of the boron-carbon bond is the basis for the use of organoboranes as a route to superior refractory materials, such as the boron carbides. By contrast, the liability or chemical reactivity of the boron-carbon bond in other organoboranes is the basis for the use of these compounds as rocket propellants. Because of the intimate connection between chemical bonding in organoboranes and their macroscopic chemical properties, it is possible to learn how pi-bonding between boron and carbon centers influences the reactivity of the boron center towards oxidants, protolyzing agents and Lewis bases. Author

N86-13520# United Technologies Corp., San Jose, Calif. Chemical Systems Div.
HIGH ENERGY MOLECULES OF HIGH SYMMETRY Abstract Only
William S. Anderson *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 2 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A series of symmetrical, fully hydroxyl-substituted organic materials is to be prepared and then converted to new, oxygen-rich, high-energy derivatives. The densities, crystal structures and heats of formation of these derivatives will be determined and observed values will be compared with predictions. The expected outcome is a better understanding of the relationship between chemical structure, density, oxidizing power and heat of formation in high-energy molecules. Author

N86-13521# Delaware Univ., Newark. Dept. of Chemistry.
STRUCTURE-DECOMPOSITION RELATIONSHIPS IN NEWER ENERGETIC MATERIALS Abstract Only
Thomas B. Brill and Yoshio Oyumi *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Insufficient information exists to discuss the relationship between the molecular structure and the chemical reactivity of energetic materials. Toward remedying this deficiency, determining the molecular structures and decomposition mechanisms of a wide range of new research-type nitramines and other energetic materials prepared by synthesis program and from efforts at Rocketdyne, Morton-Thiokol, UT/CSC, SRI, and NSWC was undertaken. X-ray crystallography is being used for quantitative structure determination, FT-IR spectroscopy at high pressure and with high heating rates and thermal methods are employed for the decomposition studies, and solid-state NMR and NQR spectroscopy is used for analyzing the molecular motion as a function of temperature. The advantage of bringing many techniques to bear on the problem is that a multifaceted understanding of the thermal behavior of an energetic material can be achieved. The results should benefit synthetic chemists and propellant researchers by showing the effects on the physical properties and product formation resulting from specific molecular modifications. Author

N86-13522# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
DEUTERIUM ISOTOPE EFFECTS IN RDX DECOMPOSITION AND COMBUSTION PROCESSES Abstract Only
Scott A. Shackelford, Stephen L. Rodgers, Michael B. Coolidge, and Robert E. Askins (Morton Thiokol, Inc., Huntsville, Ala.) *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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The thermal decomposition of RDX was examined using isothermal differential scanning calorimetery (DSC) at a temperature range of 505K to 510K. At this temperature range RDX obeys first order kinetics and shows a primary deuterium isotope effect (2.1 at 505K and 1.7 at 510K). This isotope effect would suggest that the rate limiting step in the decomposition of RDX is C-H bond rupture. Under the experimental conditions employed, the thermal decomposition occurs solely in the liquid phase with RDX. By the time the DSC has equilibrated, the decomposition has already started and the DSC trace is seen as a slow decay. No induction phase can be seen with RDX. The combustion experiments were performed in a window bomb with the burn rates measured by high speed photography. If the assumption is made that the burn rate data is directly proportional to the kinetic rate constants and that all the other factors influencing burn rate remain the same for both the deuterated and hydrogenated materials, then an isotope effect can be derived from a ratio of the RDX burn rate to RDX-d6 burn rate. The isotope effects thus obtained are 1.46 at 1000 psi and 1.37 at 500 psi. At the high temperature limit an isotope effect of 1.35 or greater can be considered to be a primary effect. R.J.F.

N86-13523# Dayton Univ. Research Inst., Edwards AFB, Calif.
FLAME MECHANISMS AND FLAME INHIBITION Abstract Only
J. D. Eversole and D. P. Weaver (AFRPL, Edwards AFB, Calif.) *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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The definition and understanding of detailed chemical mechanisms in flames are sought. Of special interest are gas-phase mechanisms responsible for, or contributing to, the suppression of afterburning in rocket plumes. An effort was made to approach the problem of determining flame chemistry with a balance between experimental data collection and theoretical flame modelling. Data

from a laminar, premixed flat-flame burner is modelled using a detailed reaction, one-dimensional laminar flame computer program. Experimental data is obtained primarily by non-intrusive, optical diagnostic techniques. Most of the uniqueness of this approach lies in the integration of many separate aspects of the general problem. R.J.F.

N86-13524# Nevada Univ., Reno. Dept. of Chemistry and Metallurgical Engineering.
THE SUPPRESSION OF AFTERBURNING IN SOLID ROCKET PLUMES BY POTASSIUM SALTS Abstract Only
Eugene Miller *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The effects of K, KOH and KO2 on the afterburning reactions are being studied by introducing them individually into an opposed jet flat diffusion flame of H2-CO-O2-N2 and scanning the flame in small increments by infrared spectroscopy. A vaporizer-burner was built permitting the vaporization of potassium and its salts prior to entering the flame. The emission spectra from the flame is detected by means of a modified absorption spectrophotometer and an optical scanning system. It was found that elemental potassium reduces the infrared radiation for rich and lean hydrogen flames but has a smaller effect on stoichiometric mixtures. KOH in a hydrogen flame inhibits the preflame reactions but actually increases the infrared radiation at levels below that required to prevent combustion totally. K therefore appears to be a more effective inhibitor than KOH as used in these experiments, settling perhaps the disagreement that has arisen in the literature concerning the efficacy of inhibition by potassium in hydrogen flames. CO was not used in these experiments because reaction between H2 and CO produced carbon in the salt vaporizer. The formation of carbon probably also occurs in the rocket plume increasing the infrared signature. Author

N86-13525# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
CHEMICAL KINETICS OF NITRAMINE PROPELLANT COMBUSTION Abstract Only
Melvyn C. Branch *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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The objective of the studies reported is to provide insight into the chemistry of reactions of gas phase species of importance in the combustion of nitramine propellants. Flame studies and associated chemical kinetic modeling of the gas reactions are being used to evaluate critical reaction paths and energetics and their influence on burn rate. The calculations thus far have identified a mechanism for the rapid reaction between CH2O and NO2 in the fizz zone at the propellant surface. A slower reaction was suggested for the preparation and flame zones standing off the surface which was supported by the exothermic reduction of NO. Both of these results provide a chemical kinetic mechanism to explain previous qualitative suggestions about the nature of the gas reactions of nitramines. The calculations also indicate that gas reactions may affect the reported product distributions in studies of nitramines. Finally, a mechanism for the modification of the reaction rate by NH3 donors was outlined. There are currently very limited experimental data available for detailed comparison to the results of the chemical kinetic modeling. Researchers began low pressure flame studies of CH2O/NO2/N2O mixtures in order to identify reactant, intermediate and product species profiles for comparison to a kinetic model of the flame. Addition of NH3 to the flame gases will also indicate the feasibility of burn rate control by NH2 donors. Author

N86-13526# Emory Univ., Atlanta, Ga. Dept. of Chemistry.
COMBUSION OF HYDROGEN AND HYDROCARBONS IN FLUORINE Abstract Only
Myron Kaufman *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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In this program both atomic and molecular flames are studied. Low-pressure premixed F2 flames are studied in a stainless-steel burner assembly equipped with CaF2 windows to spectroscopically monitor luminescence and movable Langmuir probes to measure the spacial variation of ionization. For most of the studies, the premixed flames will be diluted with He or Ar. When undiluted flames are burned in this apparatus, interesting behavior was seen in the F2-CH4 flame. Over a range of relative concentrations, including stoiciometric mixtures, this flame burns as short pulses of duration Ca. 1 msec and frequencies of 1 to 10 Hz. This behavior is explained as due to flashback resulting from the high burning velocity of these flames, followed by spontaneous reignition when the hypergolic mixture is replenished to its ignition limit. Author

N86-13527# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ANALYSIS OF HETEROGENEOUS DIFFUSION FLAME STABILIZATION Abstract Only
Warren C. Strahle and Jechiel I. Jagoda *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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The ability to calculate complex turbulent reacting flows is in a state of development. The flow investigated here presents a unique challenge to the state-of-the-art. The flow is a fully turbulent two dimensional flow over a backward facing step with wall-blowing of a combustible from the floor behind the step. It is a model for the flowfield in the flame stabilization region of a solid fueled ramjet. The analytical approach has been with a k-e method gradually being improved and modified as one progresses through various stages of complexity - from no-blowing cold flow to foreign gas injection in cold flow and then to the full combustion case. A parallel experimental program either validates the analysis or suggests modifications. Author

N86-13528# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
EXPERIMENTAL INVESTIGATION OF HETEROGENEOUS FLAME STABILIZATION Abstract Only
Jechiel I. Jagoda and Warren C. Strahle *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

In this project the solid fueled ramjet (SFRJ) is simulated by a flow over a backward facing step with a secondary flow entering the recirculation region through a porous floor. The flow properties are determined using a 2-component Laser Doppler Velocimeter (LDV) system. Bleed gas concentrations are measured, simultaneously, using Rayleigh scattering for the cold flow and spontaneous Raman for concentration and temperature measurements in flows with combustion. Although simultaneous LDV-Rayleigh or Raman measurements are currently being carried out for the simpler configuration of jet like flames, this is the first time the combined techniques are applied to the more complex and practical problems of flame stabilization behind a backward facing step. Author

N86-13529# Dayton Univ. Research Inst., Edwards AFB, Calif.
HIGH PRESSURE SOLID PROPELLANT COMBUSTION ZONE STRUCTURE FROM ANALYSIS OF HYDROXYL RADICAL CHEMILUMINESCENCE Abstract Only
David H. Campbell, Susan Hulsizer, Tim Edwards, and David P. Weaver *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p Prepared in cooperation with AFRPL, Edwards AFB, Calif. (For primary document see N86-13507 04-28)
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The results presented concern the analysis of the natural chemiluminescence originating from the hydroxyl (OH) radical in the flame above burning ammonium perchlorate (AP) composite propellant. An attempt was made to analyze quantitatively the

semi-resolved (approx. 13 nm) OH emission spectra in the 304.0 to 316.0 nm spectral range to obtain a measure of the rotational temperature and vibrational population distribution of this molecule. At present, the chemical kinetic data base is insufficient to relate the final internal energy state distribution of OH to the specific reaction pathways which produce this molecule in specific rotational-vibrational states. Nonetheless, information about the overall flame zone structure and reaction processes can be deduced from the results. Author

N86-13530# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
EVALUATION OF HMX PROPELLANT CHEMISTRY FROM RAMAN AND LASER INDUCED FLUORESCENCE SPECIES AND TEMPERATURE MEASUREMENTS Abstract Only
David P. Weaver, Tim Edwards, Susan Hulsizer, and David Campbell *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p Prepared in cooperation with Dayton Univ. Research Inst., Edwards AFB, Calif. (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The ability to accurately anticipate the behavior of burning solid rocket motor propellants is highly dependent on specific knowledge of the kinetic mechanisms and heat transfer properties of the reacting species near the surface of the burning propellant. With the development of modern laser diagnostic techniques, the possibility of determining spatially specific species concentrations and temperatures related to the distance (e.g., the reaction time) from the burning propellant surface has emerged. The goal is to gather such experimental information and to construct from it kinetic pathways in a laboratory propellant flame and to correlate their dependence on propellant composition. Such specific chemical information could then be related to known macroscopic properties of the solid propellant such as burning rate. Author

N86-13531# Dayton Univ. Research Inst., Edwards AFB, Calif.
APPLICATION OF MOLECULAR KINETICS MODELS TO THE PREDICTION OF BACKFLOW CONTAMINATION Abstract Only
David H. Campbell and David P. Weaver *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p Prepared in cooperation with AFRPL, Edwards AFB, Calif. (For primary document see N86-13507 04-28)
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The goal is to obtain a fundamental understanding of the basic physical mechanisms producing the unanticipated high level of backflow contamination observed upstream of the nozzle exit plane of spacecraft rocket nozzles and control thrusters. Information on the internal energy state population distributions, gas species number densities, flow velocities, and degree of condensation near the exit plane of a nozzle will provide the basis for more accurate modeling of the expansion flow inside the nozzle and around the nozzle lip. Such information is critical to the accurate prediction of contamination levels of sensitive spacecraft surfaces. Vibrational and rotational internal energy state populations, translational mode temperature, gas species number densities, and condensed species densities are being acquired in laboratory scale vacuum expansion flows for diatomic and triatomic gas species using non-intrusive laser spectroscopic techniques. A map of these parameters near the nozzle lip will be used to correlate the degree of non-equilibrium and the degree of condensation with the velocity field and gas number density. Author

N86-13532# Dow Chemical Co., Midland, Mich. Thermal Lab.
EVALUATION AND COMPILATION OF THE THERMODYNAMIC PROPERTIES OF HIGH TEMPERATURE SPECIES Abstract Only
Malcolm W. Chase *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 5 p (For primary document see N86-13507 04-28)
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The re-examination of the five alkaline earth metals, their dimers, oxides, hydroxides, halides, carbonates, sulfides, and sulfates was accomplished. Bibliographies, data graphs, and data summaries were generated for 80 species; this will result in approximately 200 single- and multi-phase thermochemical tables. The examination of experimental/theoretical data for a given species by itself may not be sufficient to indicate potential problems, whereas the examination of families of species often reveals interesting problems and discrepancies. For example, three of the five alkaline earth metals are not well characterized thermodynamically. This study revealed problems with the calcium data. To resolve this problem, two laboratories in the U.S. are currently measuring the low temperature heat capacities and high temperature enthalpy of calcium. In addition, the simultaneous study of the 20 alkaline earth dihalides yields a large framework in which more reliable decisions can be made as to the validity of the available data as well as guide better estimates for missing data. Author

N86-13533# Aerospace Corp., Los Angeles, Calif.
CRITICAL EVALUATION OF HIGH TEMPERATURE CHEMICAL KINETIC DATA Abstract Only
Norman Cohen and Karl Westberg *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The rapid growth in chemical kinetic data and in the number of nonspecialist users of such data in DOD-related work has created a need for a reliable, easy-to-use compilation of evaluated rate data and recommended rate coefficients. To answer this need, a program for the evaluation of kinetic data and preparation of consistently formatted data sheets patterned after JANAF Thermochemical Tables was undertaken with the joint support of the Air Force Office of Scientific Research and National Bureau of Standards. The experimental data for the reactions of O storms with methane, ethane, and neopontane at temperatures below Ca. 600 K were reexamined. In the case of methane and ethane, a set of elementary reactions was assembled that describes the complex chemistry occurring in the original studies. With the aid of previously written computer codes, the original data were reanalyzed. It was found in both cases that the measurements were especially sensitive to errors caused by secondary reactions not taken into account originally and to impurities in the reagent alkane. It appears, qualitatively, that the values for the O + CH4 and O + C2H6 rate coefficients were overestimated by approximately factors of 2 to 3 in the 250 to 600 K temperature range. Author

N86-13534# Rockwell International Corp., Canoga Park, Calif.
FUNDAMENTAL STUDIES OF AZIDE DECOMPOSITION AND COMBUSTION Abstract Only
Joseph E. Flanagan, Dean O. Woolery, and Wallace W. Thompson *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The utilization of azide (-N3) ingredients is rapidly increasing in a wide spectrum of Air Force applications. Azide materials are primarily characterized by their high positive heats of formation in addition to unique combustion features such as inherent high-burning rates and self-extinguishment at pressure above ambient. The decomposition and combustion characteristics of various aside ingredients via high temperature, high heating rate pyrolysis-gas chromatography-mass spectrometry is discussed. The approach is threefold: (1) azide decomposition chemistry with structure is defined; (2) the effect of amide decomposition chemistry upon selected propellant ingredients is investigated; and (3) the decomposition phenomena is correlated with propellant burn rates. The effort during the first year resulted in a determination of azide decomposition chemistry via high pressure (30 to 500 psig), high heating rate pyrolysis of various azide ingredients consisting of: (1) aliphatic azides; (2) asidonitramines; (3) asidoalcohols; (4) multi-substituted azides; (5) cyclic azide monomers; and (6) azide polymers. Author

N86-13535# AeroChem Research Labs., Inc., Princeton, N. J.
STABILITY OF RDX, AP AND BTTN NEAR ROOM TEMPERATURE Abstract Only
Douglas B. Olson and Robert J. Gill *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The overall objective is to gain a more fundamental understanding of chemical reaction mechanism and kinetics responsible for aging of solid rocket propellants at near ambient temperature. The chemical aging process is envisioned to result from the slow decomposition of some ingredients producing highly reactive species which then chemically attack other ingredients, especially the polymer binders. The present studies include the decomposition kinetics of selected pure ingredients as well as the degradation reactions of two binders. Mechanisms will be postulated, using the measured kinetic parameters, and the predictions of his chemical aging model will be compared with available data. A noteworthy aspect of this program is the use of highly specific and ultrasensitive analytical probes which allow studies to be performed at realistic storage temperatures, over a short time spans, and with little degradation, compared to the more usual accelerated testing at high temperatures, which then requires extrapolation of rate coefficients over many decades. Progress to date included measurements of the low temperature decomposition rate coefficients of RDX, AP, and BTTN using gas evolution analysis. Author

N86-13536# Atlantic Research Corp., Alexandria, Va.
FUEL-RICH SOLID PROPELLANT BORON COMBUSTION Abstract Only
Merrill K. King and James J. Komar *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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Boron particle combustion is retarded by initial presence of an oxide coating. In current boron ignition models, oxygen is assumed to dissolve in the oxide and diffuse to the b/B2O3 interface for reaction. Measurements of exotherms for oxide-coated particles in hot O2/N2 mixtures have quantified oxidation rates, but have not unequivocally established whether oxygen or boron (suggested by theoretical solubility considerations) moves across the oxide. Possible non-equilibrium condensation of boron oxide/hydroxide products during rapid cooling (e.g., nozzle expansion) is also important. Significant performance is lost without such condensation. Past condensation studies have been conducted under unrealistic conditions or involved limited diagnostics, inadequate for mechanism definitions. Regarding the first problem, a unique experiment utilizing two sealed vessels (one containing argon, the other an argon/oxygen mixture) Separated by a controlled thickness/temperature liquid B2O3 film on a porous platinum disk, will be performed. In the second task, a unique combination of large diagnostids and a 2-D windowed expansion section (with pressure taps) attached to a gaseous combustor will be used to quantify oxide/hydroxide condensation pressure at realistic conditions. Author

N86-13537# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
CRACK GROWTH BEHAVIOR IN A COMPOSITE PROPELLANT WITH STRAIN GRADIENTS Abstract Only
C. T. Liu *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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The main objective of the Structural Mechanics Research Program is to advance the current understanding of the crack growth behavior in solid propellants. The specific objective of this present research program is to investigate the crack growth behavior in solid propellant in the presence of nonuniform, gross applied strain fields. In this study, the crack growth behavior in a highly filled composite propellant with strain gradients was studied through the use of precracked biaxial specimens. Two different shapes of biaxial specimens were considered; namely, the rectangular shape and the wedge shape. Through cracks with different crack lengths and eccentricities, with respect to the vertical centerline of the specimen, were cut along the horizontal centerline of the specimen. Crack propagation tests were conducted under a constant strain rate condition at room temperature. The measured crack length, load, and time served as input to a computer program that calculated the crack growth rate and the stress intensity factor, and then determined the functional relationship between these two parameters. B.W.

N86-13538# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
NONLINEAR MODELING AND METHOD OF PREDICTING CRACK GROWTH Abstract Only
C. T. Liu *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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In the past decade, many experimental studies were directed primarily toward the characterization of fracture behavior in solid propellants under various loading conditions. The experimental results revealed that despite the nonlinear nature of these types of materials, linear viscoelastic fracture mechanics theory or slightly modified nonlinear versions had been successfully used in characterizing the crack growth behavior in same propellants. In order to characterize the fracture behavior in solid propellant, under realistic and general loading conditions, the effect of material nonlinearity on the crack initiation and the subsequent crack growth is required. The objective of this study is to develop a nonlinear crack growth model which can be used to characterize crack growth under large deformation conditions and to determine the range of applicability of the linear theory in predicting crack growth. The approach will involve a combination of analytical and experimental studies. Experiments (destructive and nondestructive) will be conducted to determine the failure process, the damage zone, the failure property, and the strain field ahead of the crack tip. This information will be used to determine the damage parameters associated with the nonlinear viscoelastic constitutive equation and to determine, together with the criteria developed from the theoretical analysis, the failure process zone. B.W.

N86-13539# Dayton Univ., Ohio.
HIGH-RESOLUTION MOVIES OF PROPELLANT DEFLAGRATION Abstract Only
Roger J. Becker, Paul F. Luehrmann, and Janet L. Laird *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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This program has been designed to enhance the understanding of the behavior of the particles at the surface of a grain during deflagration. A special emphasis has been placed on qualitative knowledge of particles and agglomerates ranging in size from 20 to 70 micrometers. Cooperative behavior and the nature of the immediate particle environment are of particular concern. The ultimate goal of this initative is experiments correlating particle behavior with external parameters, such as the flow field and pressure oscillations. The unique capability of the newly developed copper-vapor laser has been exploited as a light source for front-lit cinephotography. The 30 ns pulse width, 1.2 mj pulse energy, and 5 kHz repetition rate of this laser are ideal for front-lit cinephotography. The short pulse width freezes the motion, the high-energy, monochromatic pulse penetrates the flame, and the 5 kHz repetition rate captures dynamic phenomena. A diode-array detector has also been developed for the servo positioner, due to severe depth-of-field restrictions. B.W.

N86-13540# Purdue Univ., West Lafayette, Ind. School of Aeronautics and Astronautics.
WIDE DISTRIBUTION PROPELLANTS Abstract Only
Robert A. Frederick, Jr. and John R. Osborn *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

The goal of this research program is to identify conditions which produce local stepwise burning of solid propellants and to identify the physical processes that control the duration of the burn periods and rest periods. Perfecting a technique to continuously measure the local burning rate is a major task in achieving this goal. Measurements are first completed using high-speed photography as a preliminary screening tool. The desired technique, however, is a direct measurement using a laser position detector (LPD). This LPD is being designed and developed to continously record spatially local (40 micron diameter circle), high resolution (20 micron) distance measurements. With an adequate technique perfected, systematic composition are examined to determine the role of AP ignition and combustion properties, and the energetic nature of the binder on the local and average burning rate. Specifically, the binder curative, oxidizer modal size ratio, and pressure are investigated as independent variables. B.W.

N86-13541# United Technologies Corp., San Jose, Calif. Chemical Systems Div.

COUPLING BETWEEN VELOCITY OSCILLATIONS AND SOLID PROPELLANT COMBUSTION Abstract Only

R. S. Brown, A. M. Blackner, P. G. Willoughby, and R. Dunlap *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

Cold-flow studies are being conducted to define and characterize the basic flowfield and heat transfer mechanisms controlling the coupling between the acoustic velocity and the solid combustion zone. This coupling produces a substantial effect on the overall stability of the combustion pressure, yet substantial deficiencies exist in the current basic knowledge. Previously reported measurements of the oscillatory heat transfer demonstrate that this coupling is extremely nonlinear at relatively low acoustic pressures ($< 0.4\%$). The data also show that the current heuristic model for velocity coupling (which is incorporated into the Standard Stability Prediction Program) is largely wrong; the differences in the head-end and aft-end coupling are reversed from those predicted by the conceptual model. Radial profiles of the acoustic velocity have been measured at several axial stations for two surface Mach numbers, frequencies, and acoustic pressure levels. B.W.

N86-13542# Georgia Inst. of Tech., Atlanta. Dept. of Aerospace Engineering.

FLAME-ACOUSTIC WAVE INTERACTION DURING AXIAL SOLID ROCKET INSTABILITIES Abstract Only

Ben T. Zinn, Brady R. Daniel, Jechiel Jagoda, Uday Hedge, and Subra V. Sankar *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

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This theoretical and experimental research program is concerned with the determination of: (1) the processes which control the driving of axial instabilities by solid propellant flames, and (2) whether existing models can indeed determine the interactions between solid propellant flames and oscillatory flow fields. Since experimental investigation of actual solid propellant flames is currently not possible because of the extremely small dimensions of their combustion zones, the present study investigates the characteristics of a premixed, flat flame stabilized within an acoustic boundary layer next to a porous side wall in a specially developed experimental setup. In this setup, a combustible mixture enters the duct through the porous side wall and it burns in a flat flame stabilized at some distance downstream of the wall which permits performing the indicated diagnostics. Simultaneously, the response of this flame to acoustic excitation is modeled using an approach similar to those utilized to model the responses of solid propellant flames. B.W.

N86-13543# Brigham Young Univ., Provo, Utah.

MECHANISMS FOR ACOUSTIC SUPPRESSION Abstract Only

Merrill W. Beckstead and R. L. Raun *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

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Acoustic suppressants are commonly added to low smoke and smokeless propellants to avoid the problem of combustion instability. Suppressants apparently work by one or more of three mechanisms: (1) energy loss due to viscous dissipation due to drag forces, (2) modification of the propellant combustion response function, or (3) energy interchange due to distributed combustion. Viscous dissipation of acoustic energy by drag forces on a suspended particle is the most commonly recognized mechanism, being a direct analogy to suspended moisture in a fog. A second mechanism can occur with solid additives within the propellant that has a catalytic influence on the combustion response. The third mechanism considered is due to the effect of a particle burning as it traverses a relatively large portion of the system. As it does go, the interchange of energy between the burning particle and the acoustic environment can result in either a driving or damping contribution to the acoustics of the system. This third mechanism is the primary area of study of the current contract. The principle objective of this work is to identify and develop an understanding of the mechanisms whereby acoustic suppressants modify an acoustic wave. B.W.

N86-13544# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.

FLOW FIELD EFFECTS OF COMBUSTION INSTABILITY Abstract Only

T. J. Chung *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

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The main topic of research during the past two years has been the theoretical and numerical studies of the coupling mechanism of acoustic and hydrodynamic wave oscillations and its effects on combustion instability. A question arises: What happens if acoustic oscillations are coupled with the hydrodynamically oscillating system? To see this phenomenon, a rocket motor simulator is considered. An expression is derived for the growth constant in the form, alpha = alpha sub A + alpha sub H, where alpha sub A and alpha sub H refer to the growth constants corresponding to acoustic and hydrodynamic oscillations, respectively. Alpha sub A is a function of the mean flow velocity, acoustic pressure and frequencies, whereas alpha sub H is a function of additional variables such as the vortical component of velocity and hydrodynamic (vortical) frequencies as well as those for alpha sub A. Finite elements are utilized for calculations of mean flow fields, eigenvalue analyses, and the evaluation of the growth constant integrals. Based on this research, it is concluded that an acoustic coupling with hydrodynamic oscillations causes the hydrodynamic stability boundaries to expand into higher as well as lower frequency regions. B.W.

N86-13545# Hersh Acoustical Engineering, Chatsworth, Calif.

ROCKET MOTOR FLOW-TURNING LOSSES Abstract Only

Alan S. Hersh *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

Flow-turning losses represent one of the least understood mechanisms in the acoustic gain and loss estimates used in rocket motor stability calculations. According to theoretical models proposed by Culick, acoustic energy is absorbed during the energy exchange process governing the interaction between mean flow and longitudinal waves within the interior of rocket motors. A series of experimental investigations were undertaken to provide fundamental understanding of the flow-turning acoustic loss mechanisms. The experimental investigation was unique in four important ways. First, meaningful test data was collected using injection volume flow rates on the order of 100 times the values used in Culick's tests. Second, the detailed two-dimensional surveys of the mean and acoustic profiles across the injection test section were conducted. Third, the effects of mean flow urbulence were removed

by signal processing. And fourth, acoustic energy flux losses across the injection test section were directly measured. B.W.

N86-13546# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C.
OVERVIEW: AFOSR INTERESTS IN ROCKET PROPULSION Abstract Only
Leonard H. Caveny *In its* AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 2 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Rocket propulsion requirements, both present and planned, present important challenges that are not addressed adequately by present technologies. Future propulsion systems must be improved to assure that the winning edge is maintained. Because of the recent emphasis on space and the reusable launch vehicle capability to low Earth orbit new considerations for advanced propulsion for orbit transfer are investigated. Transferring the projected large payloads using conventional propulsion imposes severe limitations on the missions. For example, 70% of the mass delivered to low Earth orbit may be the chemical propulsion system required to raise the other 30% (i.e., the active payload) to geosynchronous Earth orbit; nonconventional propulsion offers the promise of reversing this ratio of propulsion and payload masses. Fundamental processes are discussed related to beamed energy and solar propulsion, i.e., radiation transmission and absorption in flowing media, plasma initiation, and chamber configurations. Electric propulsion concepts are also reviewed. B.W.

N86-13547# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
INTERACTION OF MULTI-DIMENSIONAL MEAN AND ACOUSTIC FIELDS IN SOLID ROCKET COMBUSTION CHAMBERS Abstract Only
Joseph D. Baum and Jay N. Levine *In its* AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The objective of the present research project is to seek an understanding of the physical mechanisms by which energy is exchanged between the mean and acoustic flow fields in resonance combustion chambers (in particular, solid rocket motors). These processes which have the potential of contributing significantly to the growth or decay of pressure oscillations in solid rocket chambers, have been the subject of much speculation in the past, but have never been thoroughly investigated. Specifically, the phenomena to be investigated are the interaction between the acoustic field in a chamber and a free shear layer (i.e., vortex shedding) and the so called flow turning effect (i.e., energy transfer between the acoustic field in the combustor and the mean flow of combustion products entering the chamber parallel to its axis). A computer program was developed to solve the time dependent, turbulent, compressible Navier-Stokes equations that describe the flow in a combustion chamber and a hard wall tube (utilized to study the phenomenon of sound wave propagation in a coexisting sheared mean flow). Studies were conducted to evaluate explicit versus implicit codes (implicit was chosen as more computationally efficient) and proper definition of the boundary conditions. B.W.

N86-13548# Tennessee Univ., Tullahoma. Center for Laser Applications.
LASER THERMAL PROPULSION Abstract Only **c36**
Dennis Keefer, Carroll Peters, Herbert Crowder, and Richard Wells *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Laser sustained plasmas (LSP) have been proposed as a means of converting beamed energy from a remotely located laser to provide efficient propulsion for orbital transfer. Successful implementation of this concept requires that the detailed energy conversion processes that control plasma stability and fractional energy absorption within the LSP be thoroughly understood. An experimental study of these mechanisms is being conducted using argon plasmas sustained by a continuous wave carbon dioxide laser in a controlled, forced convection flow. Detailed measurements of the plasma temperature field are obtained using digital images of the plasma continuum radiation within a narrow spectral wavelength band. Using the measured temperature field, the interaction among the absorbed laser power, thermal conduction, and thermal radiative transfer can be calculated at each point within the plasma. Author

N86-13549# Pennsylvania State Univ., University Park.
ANALYTICAL MODELING OF STRONG RADIATION GAS-DYNAMIC INTERACTION Abstract Only **c36**
Charles L. Herkle *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The principal objective of this research program is to determine the dominant characteristics of the interaction between a higher power laser beam and a flowing gas. The method of investigation is by numerical analysis with primary emphasis on the steady two-dimensional problem. The one-dimensional problem and the stability characteristics of the interactions are also being considered. The geometry of interest is the convergent portion of a converging-diverging nozzle. In particular, the analysis includes the effects of a converging laser beam with an arbitrary intensity profile. (Present calculations are using a Gaussian beam.) The mass flow through the nozzle is fixed by the back pressure when the nozzle is unchoked, and by the choking condition when the nozzle is operated supercritically. Real gas properties, including viscosity and thermal conductivity, corresponding to those of equilibrium hydrogen are used for all thermodynamic variables. The location of the heat absorption zone and the fraction of power absorbed are found by satisfying the complete conservation laws. B.W.

N86-13550# Illinois Univ., Urbana-Champaign.
EXPERIMENTAL STUDIES OF LASER-SUSTAINED ARGON PLASMAS FOR CW LASER PROPULSION APPLICATIONS Abstract Only **c36**
Herman KRier and Jyoti Mazumder *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Experimental studies of laser-sustained plasmas in pressurized flowing argon are presented. The data shows strong laser energy absorption by argon, approaching 80% at higher powers. The absorption coefficient of air is degraded by the presence of extraneous species with larger electron collisional cross sections. These tend to deexcite free electrons and lower electron temperature, reducing inverse Brehemsstrahlung absorption, the dominant absorption mechanism. The data also indicates a tendency for global absorption to rise with laser power. Plasma size is an eigenvalue solution of the steady state energy balance equations, producing a finite plasma size for a given laser power and flow conditions. The data also suggests asymptotic behavior at high power. As laser power increases, the plasma grows until it reaches a point where radiative losses from the enlarged surface area offsets the increase in power, preventing further growth in absorption length. B.W.

N86-13551# Physical Sciences, Inc., Andover, Mass.
LINEAR AND SATURATED ABSORPTION OF LASER RADIATION IN HEATED CASES Abstract Only **c36**
Robert H. Krech, Lawren M. Cowles, George E. Caledonia, and David I. Rosen *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The physical processes involved in heating the working fluid of a rocket engine with a high power CW laser beam can be simply described. The gas is injected into the stagnation/absorption zone at a temperature most probably determined by regenerative cooling requirements. As the gas flows toward the throat it is heated by absorption of laser radiation. With hydrogen as the

primary propellant constituent, the equivalent of nine 10.5 micrometer photons per molecule must be absorbed to reach a stagnation condition that yields a specific impulse of approx. 1000 s. The present program has been directed towards studying the absorption properties of potential high temperature molecular absorbers over the temperature range of 1000 to 3500 K and at CO2 (approx. 10.6 micrometers) and DF (3.8 micrometers) laser wavelengths. These measurements have been performed behind incident and reflected shockwaves. Species studied to date include H2O, CO2, NH3, SF6 and NF3. Small signal (linear) absorption coefficients have been measured for these species (including effects due to dissociation fragments). These measurements have been performed under pressure and temperature conditions, and within non-equilibrium chemical kinetic regimes, appropriate to the propulsion application. B.W.

N86-13552# Physical Sciences, Inc., Andover, Mass.
ENERGY DEPOSITION OF PULSED ONE MICRON LASER RADIATION IN H2 AND AR Abstract Only **c36**
David I. Rosen and Nelson H. Kemp *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

In RP (repetitively-pulsed) laser propulsion the propellant energy is supplied by the absorption of short, repetitive laser pulses beamed to the thruster from a remote laser power station. The four principal stages in the operation of the pulsed laser-heated thruster are as follows: (1) ignition/breakdown, (2) post-breakdown plasma absorption and growth under the influence of the laser radiation field, (3) blast wave propagation into the surrounding gas, and (4) late-time expansion and cooling of the laser-heated gas. In a previous study at PSI experimental and theoretical investigations of laser-induced gas breakdown at short laser wavelengths (< 1 micrometer) were carried out for a variety of propellant gas candidates. The results of those studies have helped to establish the threshold irradiances required to initiate an optically absorbing plasma. Experiments were performed to investigate the degree of laser optical absorption and the resulting plasma-dynamics which occurs when high energy pulses of 1.05 micrometer laser radiation are focused into various gases at focal intensities above the breakdown threshold (10 to the 10th power 10 to the 13th power w/sq cm). B.W.

N86-13553# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering, Acoustical Engineering and Mechanics.
ADVANCED ENERGY CONVERSION CONCEPT FOR MICROWAVE BEAMED-ENERGY PROPULSIONS Abstract Only **c75**
Leik N. Myrabo *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

An innovative electrostatic force generation principle was investigated. Microwave energy is beamed directly to remote RF linear accelerators (LINAC) enclosed by a specially-shaped body within a planetary atmosphere. A number of low current 5 MeV LINACs eject free-electron charge to a distance of 5 to 10 m from the body, thereby establishing a charge cloud and resultant high electric field between the cloud and body. The free electrons attach to previously neutral oxygen and water molecules, and drag the largely neutral air-mass cloud back to the body which is now positively charged. Repetitively-pulsed operation of the LINACs could give rise to quasisteady electrostatic forces, which accelerate the air-mass working fluid within a stream tube of a given capture area -- as established by the radius of the E-beam at the point of maximum range from the accelerator. Examination of the physics of global body electrostatic charging and artificial atmospheric charging, formulate a model for electrostatic force generation and to analyze the cloud/body interaction physics is proposed. The results of a first-order calculation of anticipated surface-field thrust, free charge, and stored energy are presented. E.A.K.

N86-13554# Stuttgart Univ. (West Germany).
BASIC PROCESSES OF PLASMA PROPULSION Abstract Only **c75**
Herbert O. Schrade *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The acceleration mechanisms and the electrode effects in self magnetic pulsed and continuous MPD-arc thrusters were investigated. The magnetic thrust of a MPD-arc propulsion device increases with the square of current. An explanation is put foreward which also accounts for the electrode and insulator erosion. A plasma instability leads to a deviation off the axisymmetrical current distribution and hence to a current concentration on the anode surface. A simplified rotationally symmetric, two dimensional numerical methods to calculate the flow pressure and current density field for different thruster geometries was set up. The current contour and constant pressure lines of such a numerical calculation for the MPD-Thruster assuring isothermal conditions for the electrons and an isotropic behavior of the heavy particles are shown. To gain a better understanding of the cathode phenomenon and to minimize the erosion rate in MPD-arcs an experiment was initiated. The experimental set up is shown and is placed in a vacuum test vessel which allow pressure variations between 10 to the minus 3rd power and 10,000 Pa for different gases. The electrode system is energized by a pulse forming network of electrolytic capacitors delivering a rectangular current pulse lasting about 2 ns with currents which can be varied between several hundred amperes up to 101A. The test apparatus will determine the cathode attachment behavior, the mass loss, erosion rate and surface damage for different cathode materials under various aperating conditions. E.A.K.

N86-13555# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
PERFORMANCE-LIMITING FACTORS IN MPD THRUSTERS Abstract Only **c75**
Manuel Martinez-Sanchez, Daniel Heimerdinger, Mark Chanty, and David Melanson *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Three primary questions in the physics and design of MPD thrusters are addressed: (1) based on a simplified model of the plasma physics (but still retaining the Hall effect), how should an MPD channel be lofted to insure a smooth current distribution; (2) developing a numerical simulation code for off-design or off-shape channels; (3) development of experimental tests and diagnostics to verify the above. This approach differs from the more traditional route, in which the channel shape is arrived at in a purely empirical manner, and also from earlier plasma flow analyses, where the crucial role of the Hall parameter is not accounted for. E.A.K.

N86-13556# Carnegie-Mellon Univ., Pittsburgh, Pa.
EROSION AND ONSET MECHANISMS IN MAGNETOPLASMADYNAMIC THRUSTERS Abstract Only **c75**
John L. Lawless *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Erosion is a major concern in MPD thruster design. To minimize erosion, it is desirable to operate in the diffuse as opposed to spot mode of current conduction. The following efforts are made: (1) to determine the limits of diffuse mode operation; and (2) to quantify erosion rates. At present, there are no theories to answer either question. The relationship between erosion and the experimental phenomenon of onset is clarified. E.A.K.

N86-13557*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAGNETOPLASMADYNAMIC THRUSTER EROSION RESEARCH Abstract Only **c75**

David Q. King *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
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Magnetoplasmadynamic thruster (MPdT) lifetime at sustained multimagawatt power levels is unknown but will be governed by plasma erosion of thruster surfaces. Before the thruster can be developed for an orbital propulsion application the physics of the erosion mechanisms must be studied. The following key questions that must be resolved to understand erosion are addressed: (1) what are the erosion mechanisms on the anode, cathode, and insulator and what are the quantitative rates for each; (2) what governs the cathode heat balance at high current density and magawatt power levels; (3) what governs the anode heat balance; and (4) how does the cathode work function change with time, and what effect does this have on erosion. The approach aims at developing an understanding of the erosion of the electrode and insulator surfaces by conducting experiments on a steady-state scaled-down MPD device, and by analysis of key processes. B.W.

N86-13558# SeiTec, Cleveland, Ohio.
COMPLETELY MAGNETICALLY CONTAINED ELECTRO-THERMAL THRUSTER Abstract Only
George R. Seikel *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The highest performance on electrothermal thrusters were measured. It was shown that for both in the 25kW thruster and a MW quasisteady thruster efficiency significantly increases with the applied magnetic field strength up to the experimental limits. At these field strengths the cyclotron radius of the propellant ions becomes smaller than the anode diameter, and heating, containment, and acceleration of the plasma ions can be directly accomplished by the applied radial electric field and expanding axial magnetic nozzle field. E.A.K.

N86-13559*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
PLASMA-GAS INTERACTIONS STUDIES IN A HYBRID PLUME PLASMA ROCKET Abstract Only c75
F. R. Chang, W. A. Krueger, T. F. Yang, and J. L. Fisher (Southwest Research Inst., San Antonio, Tex.) *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 2 p Prepared in cooperation with MIT, Cambridge (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Plasma-gas interaction was investigated and the basic mechanisms for energy and particle transport. The solution approach assumes cylindrical geometry and includes a multiplicity of atomic reactions, and the presence of a strong magnetic field is described. The principal reactions are electron and ion impact ionization, and charge exchange between hot ions and cold neutrals. Radial particle and energy transport is mainly by diffusion. A modified Bohm diffusion model for plasma in the core of the plume, and classical neutral particle diffusion in the cooler regions of the flow are presented. Neutrals are allowed to free stream in the low density regions, where the collision mean-free-path becomes comparable, or even larger than the characteristic dimensions of the system. E.A.K.

N86-13560*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
A TANDEM MIRROR PLASMA SOURCE FOR HYBRID PLUME PLASMA STUDIES Abstract Only c75
T. F. Yang, F. R. Chang, R. H. Miller, K. W. Wenzel, and W. A. Krueger *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p Prepared in cooperation with MIT, Cambridge (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A tandem mirror device to be considered as a hot plasma source for the hybrid plume rocket concept is discussed. The hot plamsa from this device is injected into an exhaust duct, which will interact with an annular hypersonic layer of neutral gas. The device can be used to study the dynamics of the hybrid plume, and to verify the numerical predictions obtained with computer codes. The basic system design is also geared towards low weight and compactness, and high power density at the exhaust. The basic structure of the device consists of four major subsystems: (1) an electric power supply; (2) a low temperature, high density plasma gun, such as a stream gun, an MPD source or gas cell; (3) a power booster in the form of a tandem mirror machine; and (4) an exhaust nozzle arrangement. The configuration of the tandem mirror section is shown. E.A.K.

N86-13561# Pennsylvania State Univ., University Park.
COUPLING BETWEEN GAS DYNAMICS AND MICROWAVE ENERGY ABSORPTION Abstract Only c75
Michael M. Micci *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Models of the microwave absorption regions with and without gas flows and experimental measurement of key physical parameters such as gas temperature and heat fluxes are exained. Heat losses from the absorption region and the amount of cooling gas required and its effects on final exhaust velocity and efficiency are investigated. Questions to be resolved include the relative roles of conduction, convection and radiation in transferring the absorbed microwave power to thrust power, the stability of such flows and the mixing processes of cold gas with the microwave sustained plasma. The anticipated scientific accomplishment of this program is illustrated. The research provides insight into the entire field of high temperature gas flows driven by radiation absorption. E.A.K.

N86-13562# Electromagnetic Launch Research, Inc., Cambridge, Mass.
PULSED INDUCTIVE ENERGY TRANSFER Abstract Only c75
Peter P. Mongeau and Douglas P. Hart *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The pulsed inductive acceleration process was investigated. The basic energy transfer mechanisms and the performance limitations of this device were established. It is indicated that the performance of the metallic induction reaction engine is more dependent on the density of the reaction mass material than on the conductivity of the material and that the existence of a back EMF saturation effect which can inhibit energy transfer to the pulsed inductive system. This saturation effect can be greatly reduced by using a compound pulse coil rather then a face coil to accelerate the reaction mass. E.A.K.

N86-13563# Dayton Univ., Ohio. Research Inst.
LASER DIAGNOSTICS FOR ELECTRIC FIELD MEASUREMENTS Abstract Only c75
Roger J. Becker, Blair A. Barbour, and Alan T. Buswell *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The development of accurate means to measure the electric field strength in transient plasmas with good spatial resolution is described. A nonintrusive (optical) measurement that provides reliable data in a conducting medium is described. Selection rule breakdown in a laser scattering measurement was used. The Rayleigh depolarization scattering (RDS) is directed at gas atoms and ions and highly symmetric molecules. The second method uses CARS to measure selection rule breakdown in Raman scattering, and is applied to a wide class of molecules. E.A.K.

N86-13564# Spectron Development Labs., Inc., Costa Mesa, Calif.
OPTICAL TECHNIQUE TO MEASURE ELECTRODE EROSION Abstract Only c74
James D. Trolinger and David F. Schaack *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For

primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The failure mechanism in a number of important components and systems is electrical erosion, for example, in electrical propulsion systems or other components exposed to plasmas and arcs. The ability and required technology for high sensitive optical methods to serve as a diagnostic for miniscule amounts of surface erosion are determined. E.A.K.

N86-13565# Rensselaer Polytechnic Inst., Troy, N.Y.
VARIABLE FIELD EFFECTS FOR THE ROTATING FLUIDIZED BED REACTOR Abstract Only c73
Owen C. Jones *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The rotating fluidized bed nuclear reactor is a concept which has the potential for very large power densities. Large turn-down ratios and very high specific impulses of approx. 25 to 50% higher than those associated with chemical rockets. The technical feasibility of this concept includes material studies of nuclear fuels and thermal-hydraulic studies of the behavior of rotating fluidized beds of various shapes and under centrifugal g-fields. Results of the scoping effort include: (1) evaluation of fluid-bed expansion and development of new predictive techniques; (2) evaluation of the quasi-1-dimensional coupled thermonuclear stability of reactor operation; (3) examination of the hydrodynamic stability of fluidized beds, development of some initial predictive methods, and initiation of a simple experiment to evaluate the results; and (4) evaluation of the potentially concept-killing problems associated with thermal stress in the blind end plate of the reactor. E.A.K.

N86-13566# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemical Engineering and Environment Engineering.
EFFECT OF INTERFACIAL PHENOMENA ON CONTACT LINE HEAT TRANSFER Abstract Only c34
Peter C. Wayner, Jr. *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The stability and heat transfer characteristics of the contact line region of an evaporating thin liquid film was examined. The processes of heat, mass and momentum transfer in the film thickness region delta $<$ 10 to the -5th power m was measured. A miniaturized heat transfer cell on the stage of a microscope equipped with a scanning microphotometer was used. The interfacial concepts of disjoining pressure, spreading pressure, fluid microstructure and surface tension are used to analyze the transport processes and to develop a macroscopic suction potential model for the integral heat sink. E.A.K.

N86-13567# R and D Associates, Alexandria, Va.
UNIFIED STUDY OF PLASMA-SURFACE INTERACTIONS FOR SPACE POWER AND PROPULSION Abstract Only c75
Peter J. Turchi, John F. Davis, III, Joseph Norwood, Jr., and Craig N. Boyer *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The efficiency and lifetime of high specific power/high specific impulse space power and propulsion devices often depend on particle and energy transport at electrodes and insulators in low temperature plasma flows. Actual measurements of particle and field distributions near solid surfaces in controlled plasma flows were studied and used to develop models for particle and energy transport. A unique advantage in such model development is the ability to vary flow conditions, surface orientation, and material properties and to compare data within a unified experimental framework, thereby allowing complicated interactions to be delineated. DOE

N86-13568# Rasor Associates, Inc., Sunnyvale, Calif.
CLOSE-SPACE, HIGH TEMPERATURE KNUDSEN FLOW Abstract Only c33
John B. McVey *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The discharge processes and performance characteristics of thermionic energy conversion systems operating in the collisionless (Knudsen) mode were investigated. The interelectrode space charge can be reduced by close interelectrode spacings, contact ionization of cesium at the emitter surface or introduction of ions produced in an externally generated arc. It is suggested that structured emitters can increase the current and power densities in the unignited mode by a factor of four. Small diode structures, SAVTECs, with spacing set by thermal expansion, to measure converter performance at interelectrode spacings below 20 micron were used. Measurements covered both the vacuum and unignited regimes. Two variable-spacing planar converters containing mixed cesium and barium vapor are planned to investigate the structured emitter effect. Theoretical studies and computer models of the collisionless thermionic converter and its interaction with an external arc supplement the experimental work. E.A.K.

N86-13569# SRI International Corp., Menlo Park, Calif. Chemical Physics Lab.
TWO-PROTON DETECTION TECHNIQUES FOR ATOMIC FLUORINE Abstract Only c74
William K. Bischel *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The electronic states of primary interest are shown. The two states that are the focus of the experiments are the sup 2 p sub 1/2 state at 404 cm(-1) and the sup 2 D sub 5/2 state at 117,624 cm(-1), both of which have two photon allowed transitions from the ground state. Two different types of experiments are utilized to detect and study the properties of these excited states. The experiment conducted first is the Raman excitation of the sup 2 P sub 1/2 state. The apparatus for this experiment is illustrated. This experiment will use two visible lasers. The second experiment is the direct two photon excitation of the sup 2 D sub 5/2 state. Fluorescence emission at 775 nm forms the observed signal. This experiment requires laser radiation at 170 nm. The results of both experiments are two fold: (1) new remote detection techniques for atomic fluorine is demonstrated; and (2) a wealth of new data concerning its excited states is generated. Author

N86-13570# California Univ., Berkeley. Dept. of Mechanical Engineering.
COHERENT OPTICAL TRANSIENT SPECTROSCOPY IN FLAMES Abstract Only c74
John W. Daily *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

An actively stabilized CW dye laser is used as a source. By passing the beam through a traveling wave modulator to which a high voltage pulse has been applied, the frequency may be shifted up to 15 GHz within 150 psec for periods of several nanoseconds. Thus, one may shift into or out of resonance with an absorption line of interest and observe the transient behavior that results. The type of transient observed is Free Induction Decay in which the laser beam is suddenly shifted out of resonance with an absorption line and the transient absorption signal observed. The decay rate of the transient signal is the collisional dephasizing rate for that transition. Also illustrated are several other types of excitation, the transient they produce and the quantities one can obtain. The focus of study was on CH in the low pressure flame facility. A complete layout of the equipment in two configurations, one for COTS and another for making high resolution absorption measurements, is shown. Author

N86-13571# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.

DEVELOPMENT OF VELOCITY MEASUREMENT TECHNIQUE BY PULSED LASER DOPPLER ANEMOMETRY Abstract Only **c36**

B. C. R. Ewan and J. Swithenbank *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

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The conventional point measuring ability of laser Doppler anemometry is extended to a line measurement. Two immediate requirements follow from this modification. The first is that of monitoring several points along the line measuring volume simultaneously, leading to a multichannel data collection and analysis system. The second stems from the diminished beam intensity in the measuring volume due to its extension and the need to restore scattered light intensity by increasing laser power or scattering particle diameters. Two parallel lines of study are used. The first aims at developing the optics and signal processing necessary to produce and analyze the Doppler signals. A CW argon ion laser is used operating in a conventional laser Doppler configuration, with the exception of the output lens, which is cylindrical and produces a line intersection within the measurement field. Progress with the argon ion system consists of the completion of the optical arrangement in conjunction with an air jet and suitable particle seeding, capable of producing sonic jets. The second parallel element aims at overcoming the low light level in the measuring volume using the high powers available with pulsed lasers. Author

N86-13572# Stanford Univ., Calif. Dept. of Mechanical Engineering.

QUANTITATIVE FLOW VISUALIZATION Abstract Only **c36**

Ronald K. Hanson *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 5 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

A method for visualizing a range of flowfield parameters including temperature, velocity, species concentrations, pressure, and, in the case of two-phase flows, droplet or particle distributions is established. Ideally these techniques should be applicable to nonreacting and reacting flows, including plasmas. Most of the work has utilized planar laser induced fluorescence (PLIF), except for particle visualization which uses planar Mie scattering (PMS). The approach and some representative results for temperature and velocity are given. An overview of the fluorescence based temperature sensing strategy, and representative results for instanteous temperature contours in a vertical plane in a rod stabilized, premixed CH4-air flame are provided. A schematic diagram of the two frequency strategy for monitoring velocity, also based on fluorescence, is shown and as are sample results for the axial velocity component in a subsonic, room temperature nitrogen roundjet. For temperature measurements, the light source is a pulsed dye laser system, yielding tunable output near 226 nm. For velocity visualization a tunable CW Art laser is used operating on a single axial mode near 515 nm. Author

N86-13573# Stanford Univ., Calif.

OPTICAL PROCESSING AND PHASE CONJUGATION Abstract Only **c74**

Lambertus Hesselink *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

Approaches for making quantitative measurements in combusting flows are investigated. Techniques investigated include optical and digital processing, holography and phase conjugation. Two new diagnostic techniques are investigated. The first technique is a method for obtaining species concentration in a flame using phase conjugation (DFWM). The second technique is a method for making real time velocity measurements in a plane using speckle interferometry. DFWM is superior to the alternative in that the signal strength is substantially higher, which allows for better partial resolution and S/N for a given amount of laser power. The use of a photorefractive recording material for speckle metrology allows real time measurement of velocity in a plane. The first demonstration of DFWM was achieved. The concentration of sodium in a small laboratory flame was measured using the new DFWM technique. The technique shows excellent promise as a diagnostic tool for combustion research. The real time speckle velocimetry work was started. It was demonstrated that photorefractive materials can be used as a recording medium for speckle patterns. Author

N86-13574# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.

STRATEGY FOR ADVANCED SENSING AND CONTROL OF COMBUSTION Abstract Only

Mark L. Nagurka, Juan I. Ramos, and W. A. Sirignano *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

Approaches to the sensing and control of combustion processes are investigated. A model equation describing the temperature distribution through a propagating flame was studied. The sensing and control problem is formulated such that a suitably defined flame front is driven to or maintained at a desired location. Various definitions for the flame front location have been used to generate control problems for distributed parameter systems (DPS) in a classical format. Using such a definition is possible to state an ordinary differential equation governing the flow velocity and/or mixture ratio. The flow velocity and thermochemical properties of the mixture are collapsed in one parameter V here referred to as velocity. Solution of the partial differential equation governing the temperature distribution together with the ordinary differential equation for V yields the results for the controlled problem. Two sensors at neighboring locations and the temperatures measured by them are employed to determine the velocity V. The gain of the control system is reflected through a characteristic time. Author

N86-13575# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.

THE 1-D LASER DOPPLER INSTRUMENTATION Abstract Only **c36**

Holger T. Sommer *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)

Avail: NTIS HC A11/MF A01

The development of reliable measurement of instantaneous velocity gradients by obtaining profiles of one component of the velocity vector instantly is presented. The instrument consists of the standard transmitting optics of a LDV system modified with cylindrical lenses to form laser sheets. The laser sheets cross and form a cylindrical LDV measurement volume. The fringes of the volume are oriented perpendicular to the velocity component of interest and scattered light from particles moving through the volume transmits the velocity information to the photodiode array. The signal from the photodiodes is processed in two different ways. The analog LDV-burst is stored on tape. Later on it is digitized and numerically analyzed to obtain the relevant velocity information. The second method of reducing the data involves optical frequency analysis. The laser Doppler signal detected by the photodiodes is high-pass filtered and amplified. This signal drives a Bragg-cell which acts as an optical frequency analyzer. The displacement of the first order of deflection of a laser beam passed through the Bragg-cell is proportional to the signal frequency. By feeding the laser Doppler bursts observed by different photodiodes to the Bragg-cell, and correlating the frequency proportional displacement of the analyzing laser beam with the location along the LDV-volume, a velocity profile is obtained. In order to obtain instantaneous velocity profiles, a time window is opened which is sufficiently short to time resolve the turbulence of the flow. Author

N86-13576# United Technologies Research Center, East Hartford, Conn.

RESONANT CARS DETECTION OF OH RADICALS Abstract Only **c25**

James F. Verdieck *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

CARS diagnostics was extended to minority species, in particular radicals, through the techniques of resonant CARS. The essentials of resonance CARS are illustrated. The hydroxy radical was chosen as a candidate molecule because of its seminal importance in both combustion and atmospheric chemistry. The approach taken was to achieve an understanding of the basic physics of electronic resonant CARS in OH, including effects of tuning, laser linewidth dependence, choice of electronic transition, and saturation considerations. The first observation of resonant CARS in OH was made under several conditions, including several different choices of the electronic resonant frequency. The amplitude and shape of a particular CARS spectrum are very sensitive to the precise tuning to the electronic resonance. The OH resonant CARS spectrum has a much greater amplitude than the adjacent water CARS spectrum. In addition to the experiments, the theory of resonant CARS in OH was treated. Agreement between theory and experiment is generally good, except for the experimental observation of satellite structure about the central line. Author

N86-13577# Aerometrics, Inc., Mountain View, Calif.
SPRAY CHARACTERIZATION USING PHASE ANGLE DETECTION Abstract Only c34
William D. Bachaio *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A method with the potential for obtaining spray drop size and velocity measurements in sprays, two-phase flows, and eventually, in spray combustion is under investigation. The Phase/Doppler method is a unique method for obtaining drop size information wherein the measurements are obtained from the phase of the scattered light. The exact Mie theory was used to verify these results and to investigate the possible effects of light scattered by the combined mechanisms of refraction and reflection. The Mie theory allowed the identification and avoidance of these regions. Calculations based on the simple geometrical optics approach were in excellent agreement with the experimental data for particles greater than 5 micrometers in diameter. Mie theory calculations demonstrated that particles as small as 1 micrometer can be measured. The method consists of an optical system which is the same as a LDV except that three detectors are located at selected spacings behind the receiver aperture. Experiments were conducted to disclose any practical limitations of the method. Monodisperse drop streams were used in conjunction with sprays in the optical path to assess the impact, if any, of random beam attenuations and distortion. Sprays typical of those found in gas turbine combustors were measured. The size distributions, size-velocity correlations, mean and rms velocities for each size class, and the time of arrival were obtained. Author

N86-13578# Yale Univ., New Haven, Conn. Center for Laser Diagnostics.
LASER EMISSION AND COHERENT RAMAN SCATTERING FROM INDIVIDUAL FLOWING DROPLETS Abstract Only c36
Richard K. Chang, Marshall B. Long, and Roman Kuc *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

It may be possible to use the coherent but nondirectional laser emission from individual particles as active markers for flow field visualization and remote illumination. In particular, new applications may be viable with coherent emission droplets as velocimetry markers in otherwise optically dense two phase flows and in overhwelmingly high elastic scattering environments such as near a solid boundary. Furthermore, determination of the chemical species of individual droplets appears to be possible with coherent Raman emission. New research was initiated on the nonlinear optical emission from water droplets and ethanol droplets with and without Rhodamine 6G or Courmarin dyes. Laser emission from individual liquid ethanol droplets containing Rhodamine 6G at wavelengths commensurate with morphology dependent resonances (MDRs) was observed. For a conventional dye laser, optical feedback at selected wavelengths is provided by an external wavelength dispersive element. For a droplet dye laser, higher Q at selected wavelengths is provided by the MDRs associated with the liquid-air interface of the droplet. At these resonances, standing waves result from the total internal reflection at the liquid-air boundary of counterpropagating waves close to the circumference of the droplet. Stimulated Raman scattering (SRS) from individual H2O or ethanol droplets at wavelengths commensurate with MDRs and the spontaneous Raman-Stokes radiation was observed. Author

N86-13579# Yale Univ., New Haven, Conn. Center for Laser Diagnostics.
SIZE AND SHAPE CHARACTERIZATION OF INDIVIDUAL FLOWING DROPLETS BY LASER LIGHT SCATTERING Abstract Only c36
Richard E. Chang, Boa-Teh Chu, and Marshall B. Long *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A new technique for determining both the size changes and the shape distortions of individual droplets flowing in a linear stream is presented. This technique is based on the whispering gallery modes or more accurately morphology dependent resonances (MDRs) associated with microparicles having a rotational axis symmetry. For size and shape determination, the MDRs in the fluorescence spectra from ethanol droplets tagged with Rhodamine 6G dye were measured. Highly monodisperse tagged ethanol droplets are generated by a modified Berglund-Liu vibrating orifice generator. The droplets have a radius in the 10 to 50 micrometer range with a monodispersity of one part in 10,000 to 100,000 and spacing within a linear stream of approx. 100 micrometer. The evaporation of droplets within a linear stream can be readily determined by measuring the wavelength shift of specific MDRs from successive droplets further downstream from the orifice, since the droplet decreases in size monotonically with time after exiting the orifice. The results demonstrate that the wake of preceding droplets significantly decreases the evaporation rate of a droplet within the linear stream. Author

N86-13580# Spectron Development Labs., Inc., Costa Mesa, Calif.
SPRAY CHARACTERIZATION WITH A NONINTRUSIVE OPTICAL SINGLE PARTICLE COUNTER Abstract Only c34
Cecil F. Hess *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The understanding of droplet sizing technology in combustion environments using light scattering is studied. The emphasis is on establishing what information of the scattered light is better suited to provide the size and velocity of droplets, which can then yield local mass flux measurements. The studies conducted indicate that the absolute intensity of the scattered light combined with the standard LDV will produce excellent results. This technique was combined with auto calibrating algorithms to compensate for the loss of energy experienced when the laser beams or the scattered light travel through windows and other particles along the path. This is the basis of the IMAX techniques. An alternative and unique approach, referred to as P/MAX, is also under investigation. The P/MAX technique uses beams with polarizations normal to each other. This allows the use of low power single color lasers. In order to perform mass flux measurements in addition to the size and velocity distributions, the active probe volume must be known. This probe volume is a function of particle size and several optical parameters. Author

N86-13581# Arizona State Univ., Tempe.
INTELLIGENT LASER DIFFRACTION INSTRUMENTATION FOR

PARTICLE SIZE ANALYSIS Abstract Only **c36**
E. Dan Hirleman and Joseph I. Koo *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Particle and droplet size distributions, being parameters of fundamental importance, should be priority measurement objectives for intelligent sensors in next generation propulsion systems. Unfortunately there are a number of problematic scientific issues limiting the development of laser light scattering particle sizing instruments capable of autonomous, self-diagnosing operation in hostile environments. Beam steering due to thermal gradients, multiple scattering from high number density aerosols, and contamination of windows and electro-optical components have been and will continue to be potentially catastrophic problems. The research is concentrated in three areas: development of rapid and robust computational algorithms for the laser diffraction inverse scattering problem; synergism of electro-optical detection strategies with the inverse scattering algorithms; and techniques for on-line calibration and performance evaluation particularly with respect to the potential detection and correction for multiple scattering effects. Author

N86-13582# Systems Research Labs., Inc., Dayton, Ohio.
APPLICATION OF ATOMIC FLUORESCENCE TO MEASUREMENT OF COMBUSTION TEMPERATURES IN SOLID PROPELLANTS Abstract Only
Larry P. Goss and Arthur A. Smith *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

Temperature data on the surface of a solid rocket propellant which can be related to the kinetics of the combustion process is obtained. Laser-induce-fluorescence (LIF) techniques are being used to measure the fluorescence spectrum and lifetime of an impurity introduced into the reacting material. Since spectra and lifetimes of selected impurities have shown by this research to be highly temperature sensitive over the range of interest, it should be possible to obtain a temperature profile of the reacting surface of the propellant. When two rare-earth-ion energy levels are separated by $<$ 100 cm(-1), the upper level typically will not fluoresce at low temperatures, the reason being that multi-phonon relaxation rates are extremely high with small energy gaps since fewer phonons are required for quenching. At low temperatures no population build-up occurs in the upper energy level; therefore, no fluorescence is observed. As temperature increases, population buildup in the upper level increases and fluorescence increases relative to the lower energy level. The temperature dependence of the lifetime is solely determined by the temperature dependence of the nonradiative relaxation rate. Author

N86-13583# Texas Univ. at Dallas, Richardson.
REAL-TIME, TWO-DIMENSIONAL FUEL SPRAY VISUALIZATION Abstract Only **c34**
Lynn A. Melton and James F. Verdieck (United Technologies Research Center, East Hartford, Conn.) *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

The development of specific fluorescent additives which reveal directly the desired property from the fluorescence spectrum is studied. Previous work has verified the use of such additives to provide simultaneous visualization of both liquid and vapor phases. The development of fluorescent sensors for droplet temperature measurement is described. Temperature sensor systems follow naturally from the vapor-liquid visualization studies, because both methods exploit the properties of organic exciplexes to interrogate properties of the spray. The essentials of exciplex formation and the subsequent two color fluorescence is illustrated. Because the equilibrium between the monomer and exciplex is temperature dependent, the ratio of the intensities of the emission from E* and M* in the liquid phase provide a measure of temperature in the droplet. Thus, laboratory measurements of liquid phase fluorescence spectra as a function of temperature can provide a calibration curve for the intensity ratio, at specific wavelengths, versus temperature. Author

N86-13584# Aerodyne Research, Inc., Billerica, Mass.
SINGLE PARTICLE SIZING BY MEASUREMENT OF BROWNIAN MOTION Abstract Only **c70**
Alan C. Stanton and Wai K. Cheng *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

A new optical technique for the measurement of submicron particles, using a laser interferometric system to measure the Brownian motion of isolated particles in a gas stream is investigated. By measurement of the motion of many such particles, the size distribution may be obtained. This technique is unique in that it requires no a priori assumption on the particle size distribution, nor knowledge of the particle optical properties. The experimental approach utilizes a laser interferometer system for measurement of a time dependent signal sensitive to particle displacement. To understand this approach, an appreciation of the characteristic aspects of the Brownian motion of an isolated particle is required. A representation of the motion of a 0.1 micrometer particle is shown. Random changes in particle velocity occur in characteristic times of 10 to the minus 14th power seconds due to collisions with gas molecules. With sufficient time resolution to measure instantaneous particle velocities, one would observe a Maxwellian velocity distribution. The characteristic time for the Maxwellian distribution to evolve is the relaxation time, which is a function of particle size and fluid properties. To understand the properties of the signal, the Brownian motion sensor was simulated using a Monte Carlo technique. Author

N86-13585# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
COMBUSTION BEHAVIOR OF FREE BORON SLURRY DROPLETS
F. Takahashi, F. L. Dryer, and F. A. Williams 1 May 1985 27 p (Contract F49620-82-K-0011)
(AD-A158620; MAE-1702; AFOSR-85-0559TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

This paper reports first observations of the combustion properties of isolated boron/JP-10 slurry droplets in high temperature, atmospheric pressure oxidizing streams under low Reynolds number conditions. Slurry droplets of initial diameter between 400 and 500 micrometers and initial solid mass fraction of 0.3 were studied using single-lens reflex and high speed cine photography under both self illuminated and backlighted conditions. Boron slurry droplets burned for short periods of time with an envelope diffusion flame structure, but then experienced violent disruption for all cases studied. The intensity of the disruption progress was found to be strongly influenced by the temperature of the envelope diffusion flame. The ignition of the boron particles emitted from the initial fuel droplet was also affected by this flame temperature. As this flame temperature was increased by increasing the environmental oxygen content, the disruption occurred at earlier times in the vapor phase burning period. Ignition of the boron particles at high flame temperatures ($>$ 2500K) was accompanied by a popping sound and a bright greenish flash of luminosity. GRA

N86-13586# Institut Franco-Allemand de Recherches, St. Louis (France).
SHORT PRESENTATION AND EVALUATION OF STUDIES ON THE PENETRATION OF JETS FROM HOLLOW SHAPED CHARGES IN COMPRESSIBLE MATERIALS [PRESENTATION SUCCINCTE ET EVALUATION DES ETUDES TRAITANT DE LA PENETRATION DES JETS DE CHARGES CREUSES DANS LES MATERIAUX COMPRESSIBLES]
C.-P. Woidneck 10 Sep. 1984 17 p refs In FRENCH
(ISL-NB-402/84) Avail: NTIS HC A02/MF A01

Experiments and model studies of jet penetration of hollow

charges are summarized. A comparison with the experimental results shows the low reliability of the models. Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-13587*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
DYNAMIC IDENTIFICATION FOR CONTROL OF LARGE SPACE STRUCTURES Final Report, period ending 1 May 1983
Samir R. Ibrahim Nov. 1985 64 p refs
(Grant NsG-1649)
(NASA-CR-176380; NAS 1.26:176380) Avail: NTIS HC A04/MF A01 CSCL 13B

This is a compilation of reports by the one author on one subject. It consists of the following five journal articles: (1) A Parametric Study of the Ibrahim Time Domain Modal Identification Algorithm; (2) Large Modal Survey Testing Using the Ibrahim Time Domain Identification Technique; (3) Computation of Normal Modes from Identified Complex Modes; (4) Dynamic Modeling of Structural from Measured Complex Modes; and (5) Time Domain Quasi-Linear Identification of Nonlinear Dynamic Systems. For individual titles, see N86-13588 through N86-13592.

N86-13588*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PARAMETRIC STUDY OF THE IBRAHIM TIME DOMAIN MODAL IDENTIFICATION ALGORITHM Final Report c64
Richard S. Pappa and Samir R. Ibrahim (Old Dominion Univ.) *In* Old Dominion Univ. Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 43-72 refs Previously announced as N83-10258 (For primary document see N86-13587 04-31)
Avail: NTIS HC A04/MF A01 CSCL 13B

The accuracy of the Ibrahim time Domain (ITD) identification algorithm in extracting structural model parameters from free response functions was studied using computer simulated data for 65 positions on an isotropic, uniform thickness plate with mode shapes obtained by NASTRAN analysis. Natural frequencies were used to study identification results over ranges of modal parameter values and user selectable algorithm constants. Effects of superimposing various levels of noise onto the functions were investigated. No detrimental effects were observed when the number of computational degrees of freedom allowed in the algorithm was made many times larger than the minimum necessary for adequate identification. The use of a high number of degrees of freedom when analyzing experimental data, for the simultaneous identification of many modes in one computer run are suggested. E.A.K.

N86-13589*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LARGE MODAL SURVEY TESTING USING THE IBRAHIM TIME DOMAIN IDENTIFICATION TECHNIQUE Final Report c39
Samir R. Ibrahim (Old Dominion Univ.) and Richard S. Pappa *In* Old Dominion Univ. Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 459-465 refs Presented at the AIAA/ASME/ASCE/AHS 22nd Struct., Struct. Dyn. and Mater. Conf., Atlanta, 6-8-1981 Previously announced in IAA as A81-29449 (For primary document see N86-13587 04-31)
(AIAA-81-0528R) Avail: NTIS HC A04/MF A01 CSCL 13B

The ability of the ITD identification algorithm in identifying a complete set of structural modal parameters using a large number of free-response time histories simultaneously in one analysis, assuming a math model with a high number of degrees-of-freedom, has been studied. Identification results using simulated free responses of a uniform rectangular plate, with 225 measurement stations, and experimental responses from a ground vibration test of the Long Duration Exposure Facility (LDEF) Space Shuttle payload, with 142 measurement stations, are presented. As many as 300 degrees-of-freedom were allowed in analyzing these data. In general, the use of a significantly oversized math model in the identification process was found to maintain or increase identification accuracy and to identify modes of low response level that are not identified with smaller math model sizes. The concept of a Mode Shape Correlation Constant is introduced for use when more than one identification analysis of the same structure are conducted. This constant quantifies the degree of correlation between any two sets of complex mode shapes identified using different excitation conditions, different user-selectable algorithm constants, or overlapping sets of measurements. Author

N86-13590*# Old Dominion Univ., Norfolk, Va.
COMPUTATION OF NORMAL MODES FROM IDENTIFIED COMPLEX MODES Final Report c64
Samir R. Ibrahim *In its* Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 446-451 refs Previously announced as N82-75431 and in IAA as A83-22143 (For primary document see N86-13587 04-31)
Avail: NTIS HC 04/MF A01 CSCL 13B

A technique is presented to compute a set of normal modes from a set of measured (damped) complex modes. The number of elements in the modal vectors, which is equal to the number of measurements, can be larger than the number of modes under consideration. It is also shown in this paper that the practice of normal mode approximation to complex modes can lead to considerably large errors when the modes are too complex. A numerical example and a simulated experiment are presented to illustrate the concepts discussed and to support the theory presented. Author

N86-13591*# Old Dominion Univ., Norfolk, Va.
DYNAMIC MODELING OF STRUCTURES FROM MEASURED COMPLEX MODES Final Report c39
Samir R. Ibrahim *In its* Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 898-901 refs Previously announced in IAA as A82-30186 and A83-32988 (For primary document see N86-13587 04-31)
Avail: NTIS HC A04/MF A01 CSCL 13B

A technique is presented to use a set of identified complex modes together with an analytical mathematical model of a structure under test to compute improved mass, stiffness and damping matrices. A set of identified normal modes, computed from the measured complex modes, is used in the mass orthogonality equation to compute an improved mass matrix. This eliminates possible errors that may result from using approximated complex modes as normal modes. The improved mass matrix, the measured complex modes and the higher analytical modes are then used to compute the improved stiffness and damping matrices. The number of degrees-of-freedom of the improved model is limited to equal the number of elements in the measured modal vectors. A simulated experiment shows considerable improvements, in the system's analytical dynamic model, over the frequency range of the given measured modal information. Author

N86-13592*# Old Dominion Univ., Norfolk, Va.
TIME-DOMAIN QUASI-LINEAR IDENTIFICATION OF NONLINEAR DYNAMIC SYSTEMS Final Report c66
Samir R. Ibrahim *In its* Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 35-43 refs Presented at the AIAA/ASME/ASCE/AHS 24th Struct., Struct. Dyn. and Mater. Conf., Lake Tahoe, Nev., 2-4 May 1983 Previously announced in IAA as A83-29811 and A84-36495 (For primary document see N86-13587 04-31)
(AIAA-83-0811-CP) Avail: NTIS HC A04/MF A01

A time-domain linear modal identification technique is applied to identify some highly nonlinear dynamic systems. The modal concept is used to identify such nonlinear systems with the understanding that the resulting modes are only a mathematical representation of the series solution of the nonlinear system under consideration. Naturally, these identified modal parameters are not unique, for nonlinear systems, since they are functions of the systems' amplitudes and hence referred to as quasi-linear. The

approach presented in this paper can be useful in predicting signs of nonlinearities when linearity is assumed. It can also be used to analyze and understand types of nonlinearities of nonlinear systems through successive identifications at different levels of responses.
Author

N86-13593# Grumman Aerospace Corp., Bethpage, N.Y. Corporate Research Center.
TIRE-SOIL INTERACTION MODEL FOR TURNING (STEERED) TIRES Final Report, Aug. 1984 - Mar. 1985
L. L. Karafiath Jul. 1985 34 p
(Contract DAAE07-81-C-4028)
(AD-A157737; RE-700; TACOM-TR-13107) Avail: NTIS HC A03/MF A01 CSCL 13/6

A review of the experimental information on the development of lateral forces on tires traveling at an angle to their center plane is presented and the usefulness of the consideration of the lateral forces for the development of an analytical model is evaluated. Major components of the lateral force have been identified as the forces required to balance the tractive force and the drawbar pull vectorially. These are the shear stresses developing in the contact area and the horizontal component of the normal stresses acting on the in-ground portion or the curved side walls of the tire. The tire-soil interaction model for steady state straight travel has been expanded to include the necessary algorithms for the calculation of these lateral forces. The pattern of tractive force-slip and longitudinal-lateral force relationships is in general agreement with experiments. Author (GRA)

N86-13594# Kerr (Arnold D.), Wilmington, Del.
APPLICATION OF PASTERNAK MODEL TO SOME SOIL-STRUCTURE INTERACTION PROBLEMS. VOLUME 1: SOLUTIONS FOR PLATES CONTINUOUSLY SUPPORTED ON A PASTERNAK BASE Final Report
A. D. Kerr May 1985 31 p 2 Vol.
(Contract DACW39-85-M-1533)
(AD-A157776; WES/TR/K-85-1-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13/13

This study is reported in two volumes concerning the analyses of continuously supported structures and their foundation responses. Volume I presents the research for the Pasternak Base support and utilizes it for solutions in situations arising with structures. Solutions are offered for a variety of plates subjected to the different loading conditions occurring in the design of such structures. Volume II similarly gives methods of parameter determination of foundation models for use in supported-structure analyses. Four methods for determining the parameter are discussed in detail. GRA

N86-13595# Kerr (Arnold D.), Wilmington, Del.
APPLICATION OF PASTERNAK MODEL TO SOME SOIL-STRUCTURE INTERACTION PROBLEMS. VOLUME 2: DETERMINATION OF FOUNDATION PARAMETERS AND THE CHOICE OF MODELS Final Report
A. D. Kerr May 1985 25 p 2 Vol.
(Contract DACW39-83-M-1533)
(AD-A157777; WES/TR/K-85-1-Vol-2) Avail: NTIS HC A02/MF A01 CSCL 13/13

This study is reported in two volumes concerning the analyses of continuously supported structures and their foundation responses. Volume 2 gives methods of parameter determination of foundation models for use in supported-structure analysis. Four methods for determining these parameters are discussed in detail. Though the last of these, Method 4, has gained reputable comments concerning its calculation of model parameters, the author exposes this method as conceptually invalid, contrary to its acceptance and recognition. The proper methods for determining suitable foundation models and their corresponding parameters are offered. Volume 1 documents research for the Pasternak Base model and its implementation for design of hydrotechnical structures. Solutions are offered for a variety of plates subjected to the different loading conditions common to Corps of Engineers structures. Author (GRA)

N86-13596# Department of the Navy, Washington, D. C.
A METHOD FOR MELT-COATING A SURFACE Patent Application
D. L. Miller, inventor (to Navy) Filed 1 Jul. 1985 12 p
(AD-D011866; US-Patent-Appl-SN-750218) Avail: NTIS HC A02/MF A01 CSCL 13/8

A method for coating a surface comprises providing an electrostatically charged powder, irradiating the powder with energy until the powder or the surface melts, and allowing the surface to solidify. Electrostatically charging a powder causes a charge to be placed on the surface of each particle. It is sometimes referred to as ionizing the powder. If sufficient charge is placed on the powder, the effect is to decrease the bulk density of the powder by increasing the separation between some or all the particles. It is the increased separation that improves the absorption of energy by a powder. GRA

N86-13597# Department of the Navy, Washington, D. C.
NOZZLE FOR SELF-CONTAINED CUTTING TORCHES Patent Application
P. W. Proctor and R. L. Dow, inventors (to Navy) Filed 17 Jun. 1985 16 p
(AD-D011875; US-Patent-Appl-SN-745738) Avail: NTIS HC A02/MF A01 CSCL 13/9

A self contained jet perforator torch for defining large holes in a workpiece such as a large bomb, includes a plurality of ports fluidically connecting a combustion chamber with a slot-like chamber. The ports and the slot-like chamber extend at and angle with respect to the longitudinal centerline of the torch whereby fluid exiting the torch contacts a workpiece at an angle with a normal extending from the workpiece. GRA

N86-13598# Lawrence Livermore National Lab., Calif.
EFFECTIVE MEDIUM THEORY FOR PARTIALLY SATURATED POROUS SOLIDS
J. G. Berryman and L. Thigpen Jul. 1985 16 p refs Presented at the Multiple Scattering of Waves in Random Media and Random Rough Surfaces, University Park, Pa., 29 Jul. 1985
(Contract W-7405-eng-48)
(DE85-016608; UCRL-92358; CONF-850787-1) Avail: NTIS HC A02/MF A01

In the theory of elastic composites, one may construct an effective medium theory by choosing the effective moduli so the forward scattering from isolated elastic inclusions vanishes on average. In the theory of partially saturated porous media, the analogous problem requires knowledge of the multipole scattering coefficients for elastic scattering from isolated inhomogeneities in a fluid-saturated porous medium. Using Biot's equations of poroelasticity, these coefficients for single-scattering from spherical inhomogeneities have been calculated. When these coefficients are used to construct an effective medium theory, the resulting formulas for the effective density and bulk modulus of the composite (liquid/gas) fluid recover Wood's well-known results. Equations for wave propagation through partially saturated porous media with the coefficients deterimined by the effective medium results predict wave speeds agreeing with experiment in the seismological frequency range. DOE

N86-13599# Sandia National Labs., Albuquerque, N. Mex.
DISCUSSION ON THE VIBRATION PROCESS STANDARDS 9958002 AND 9958004
F. Cericola 1985 6 p Presented at the 41st Meeting of the IMOG Subgroup on Environ. Testing, Miamisburg, Ohio, 18 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-017116; SAND-85-1807C; CONF-8506117-3) Avail: NTIS HC A02/MF A01

The Vibration Process Standards 9958002 and 9958004 are Sandia documents that cover the requirements of sinusoidal and random vibration testing with respect to instrumentation, calibration equipment capability and test methods. A six-month calibration procedure for random vibration digital signal analyzers has been

developed, and changes are proposed to the six-month waveform distortion survey required by the standards. DOE

N86-13600# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
24 Jun. 1985 198 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-85-020) Avail: NTIS HC A09/MF A01

Numerous topics related to China's science and technology efforts are discussed. Topics include plasma control in tokamak devices, high energy physics, integrated optics, the application of computers to analytical chemistry, and optically pumped gas mixture far infrared radiation lasers. For individual titles, see N86-13601 through N86-13609.

N86-13601# Joint Publications Research Service, Arlington, Va.
PRELIMINARY EXPERIMENTAL RESULTS OF CT-6B TOKAMAK HEATING FIELD VOLTAGE FEEDBACK CONTROL c75
Zheng Shaobai and Shen Zhongqing *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 59-64 Transl. into ENGLISH from Kexue Tongbao (Beijing), no. 12, 1984 p 728-731 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

In order to maintain the constant stability of a tokamak plasma, it is necessary to control the displacement and electric current of the plasma. Generally, the control of displacement is accomplished by applying a vertical field with negative feedback. A similar approach is used in the CT-6B setup where preliminary results have been obtained. The control of plasma current is often accomplished using the method of multiple power sources which are connected sequentially. In recent years, the method of feedback control has been developed in ASDEX to ontrol plasma current. But the two controls are carried out independently. In the CT-6B setup, researchers experiemented with the idea of applying negative feedback control to the voltage of the heating field to control the plasma current and displacement simultaneously. The basic principle of this control technique and some preliminary experimental results are discussed. Author

N86-13602# Joint Publications Research Service, Arlington, Va.
SCHEME FOR HIGH-SPEED REAL-TIME DFT OPERATION FOR RADAR SIGNAL PROCESSING c32
Su Yanguang and Shi Xingrong *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 65-69 ref Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 12, no. 1, Jan. 1984 p 113-115 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

A scheme of high-speed real-time discrete Fourier transform (DFT) operation is presented for processing radar signals. It may be used to calculate the 8, 16, or 32-point DFT. When 10 MHz clock frequency is used, the operation time per point is about 4 mu s for the complex signal input sequence of 16 bits of wordlength. Under the fixed time-domain weighting adopted, it does not require more equipment or additional operation time. The control circuit is very simple. The shorter the word length of the input sequence, the faster the operation speed. Author

N86-13603# Joint Publications Research Service, Arlington, Va.
ON H PLANE DIELECTRIC LOADING THEORY FOR H PLANE FERRITE PHASE SHIFTER c33
Wen Junding *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 70-75 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 12, no. 1, Jan. 1984 p 116-119 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

The theoretical and experimental results of a nonreciprocal H plane dielectric-loaded H plane ferrite phase shifter are presented, including the approximate formula of differential phase shift and the transcendental equation of differential phase shift frequency response with zero slope. The results show that this kind of dielectric-loaded technique makes it possible to increase the differential phase shift and the figure of merit, and fabricate devices with wide band and higher average power. Author

N86-13604# Joint Publications Research Service, Arlington, Va.
NATION'S ACHIEVEMENTS IN HIGH ENERGY PHYSICS REVIEWED c73
Zhang Wenyu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 76-89 Transl. into ENGLISH from Gaoneng Wuli (Beijing), no. 3, Sep. 1984 p 1-6 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

A brief survey of China's achievements in high energy physics research is given. Particle interactions; particle accelerators; proportional, Cerenkov, and scintillation counters; and cosmic rays are among the topics discussed. R.J.F.

N86-13605# Joint Publications Research Service, Arlington, Va.
INTEGRATED OPTICS DEVELOPMENTS OVER PAST DECADE, FUTURE PROSPECTS c74
Yu Rongjin *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 90-95 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 4, 20 Apr. 1985 p 193-196 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

Some of the progress on guided-wave optics, fabrication and measurement of waveguides, devices, monolithic integration and microfabrication techniques in China over the past 10 years is surveyed. A brief comment on anticipated trends and needs in the field of integrated optics is given. Author

N86-13606# Joint Publications Research Service, Arlington, Va.
HIGH-PRESSURE, HIGH-TEMPERATURE OPPOSED ANVIL DEVICE DESCRIBED c76
He Yi, Wang Songtao, Qin Zhicheng, Wang Yaoji, and Wang Wenkui *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 96-99 Transl. into ENGLISH from Wuli (Beijing), v. 14, no. 1, Jan. 1985 p 38-39 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

Static high-temperature, high-pressure technology is an important technique for researching solid state phase changes and synthesis of materials. At present, many kinds of devices are used for conducting different high-temperature, high-pressure experiments. The structure of the Bridgman type hard alloy opposed anvil is simple but it can withstand high pressure above 100kbar, and using internal heating method, the temperature can be increased to approximately 1,000 deg. The volume of the high pressure cavity is also large. For this reason, many laboratories abroad are equipped with this kind of device. To conduct research on modification of noncrystalline alloy structures, high pressures of approximately 100kbar are frequently required to obtain greater pressure effects. For this reason, researchers set up this high-temperature, high-pressure device. The design of the container, selection of the pressure device, structure of the high-pressure cavity, and pressure adjustment are described. R.J.F.

N86-13607# Joint Publications Research Service, Arlington, Va.
APPLICATION OF COMPUTERS IN ANALYTICAL CHEMISTRY: CALCULATION OF OPTIMUM ACIDITY OF REACTION BETWEEN METAL IONS AND ORGANIC REAGENTS IN SOLUTION c25
Zhang Sunwei, Pan Fuyou, Yan Jian, and Kong Fangming *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 100-104 refs Transl. into ENGLISH from Hangzhou Daxue Xuebao (Hangzhou), v. 12, no. 1, Jan. 1985 p 98-102 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

The reactions between metal ions and organic reagents which form chelating compounds are widely used in analytical chemistry. The efficiency of chelation is related to the acidity of the reaction medium because of the competition of protons with metal ion and the tendency for the cations to become hydrolysed. The optimum acidity is generally determined experimentally. Adamovich and Salikhov and others have presented the theoretical possibility of calculating the optimum acidity in such reactions and reported

that the optimum pH value obtained by calculation tallies well with experimental value. It is relatively easy to establish a functional equation for treatment of the question, but it is difficult to find a solution after the values of all the parameters are substituted, because high degree equations are involved in most cases. The application of a computer can solve a number of complicated problems like the aioresaid. Author

N86-13608# Joint Publications Research Service, Arlington, Va.
IMPROVED ALGORITHM FOR RADAR REAL-TIME DATA PROCESSING **c32**
Zhang Zhiben *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 105-108 Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 13, no. 1, Jan. 1985 p 127-128 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

An improved algorithm of arctangent function which needs only two multiplication-division operations for radar real-time data processing is presented. In radar real-time data processing, more often than not, operations of arctangent functions are involved in order to provide an angle accuracy of half the magnitude of the smallest angle measurable with radar. A basic requirement in radar real-time data processing is speed, consequently, the number of operations of multiplication and division employed should be reduced to a minimum. Author

N86-13609# Joint Publications Research Service, Arlington, Va.
PULSED, OPTICALLY PUMPED GAS-MIXTURE FIR LASERS **c36**
Pan Chengzhi, Han Shaoping, Qin Yi, Hou Qiguo, and Liu Xiuyun *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 122-125 refs Transl. into ENGLISH from Dianzi Chengzhi (Beijing), v. 13, no. 1, Jan. 1985 p 117-119 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

With D2O-CH3I, D2O-CH3F, CH3I-CH3F and D2O-CH3I-CH3F gas mixtures as the active media of far infrared radiation (FIR) lasers, individual FIR laser lines emitted from component gases can be obtained from the same laser simply by tuning the pumping lines of a TEA-CO2 laser. The gas-mixture FIR laser is considered as a new and feasible scheme for producing multiwavelength output in FIR band from the same FIR laser. The results of using gas mixtures as lasing materials are discussed. Binary and tertiary gaseous mixtures of D2O-CH3I, D2O-CH3F, Ch3I-CH3F and D2O-CH2I-CH3F were studied. Author

N86-13610# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY
28 Oct. 1985 73 p Transl. into ENGLISH from various West European articles
(JPRS-WST-85-030) Avail: NTIS HC A04/MF A01

The report is divided into sections on aerospace, biotechnology, computers, factory automation, and microelectronics. Some featured articles are: (1) Dornier develops high resolution display system; (2) Silicon on insulator research; and (3) Development of MBS process for laser, chip manufacture. For individual titles, see N86-13611 through N86-13615.

N86-13611# Joint Publications Research Service, Arlington, Va.
FRG'S DORNIER DEVELOPS HIGH-RESOLUTION DISPLAY SYSTEM **c36**
Hans-Peter Engelhardt *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 28 Oct. 1985 p 17-20 Transl. into ENGLISH from Dornier Post (West Germany), no. 4, 1984 p 21-23 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

Geographic representations, especially maps, increasingly have to be annotated with rapidly changing supplementary information, e.g., military positions. For this purpose, Dornier has developed the GEOGRID system, the main components of which are mass memory (laser disks), a high resolution display controller (HADIC) and a high resolution color raster display. This system is briefly discussed. Author

N86-13612# Joint Publications Research Service, Arlington, Va.
THOMSON, CNET OF FRANCE IN SILICON-ON-INSULATOR RESEARCH **c33**
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 28 Oct. 1985 p 34-36 Transl. into ENGLISH from Electron. Actualites (Paris), 8 Mar. 1985 p 1 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

A cooperation agreement involving research on a silicon-on-insulator technology designed to make circuits with a low sensitivity to radiations was just signed. This technology should eventually replace the SOS (silicon-on-sapphire) technology still used by Thomson Semiconductors to make military and space circuits, but whose progress is hamperd by problems of cost and defects in the epitaxial layer. The implications of research in this direction are discussed. Author

N86-13613# Joint Publications Research Service, Arlington, Va.
EXCIMER LASER PRODUCES .2 MICRON SEMICONDUCTOR STRUCTURES **c76**
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 28 Oct. 1985 p 37 Transl. into ENGLISH from Chem. Rundschau (West Germany), 31 May 1985 p 5 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

Semiconductor structures 0.2 micrometers in size were manufactured by using the light of an excimer laser in the contact printing method. To increase the storage capacity of a chip, microstructures must become more and more fine and with that their manufacturing methods become more and more expensive. Optical methods for producing such highly resolved structures have the advantage that the light can be basically focused on a point which is about the size of the wavelength used. Excimer lasers which emit between 193 nm and 351 nm, because of very short wavelengths and high UV output are predestined for making highly resolved structures by using photolithography. Microstructures 0.2 micrometers in size can be produced by using the light of an excimer laser. Structural fineness of 0.7 micrometer in size needed to manufacture 4M-bit memories and hyperfrequency GaAs semiconductors can be implemented with the UV light from this laser. Author

N86-13614# Joint Publications Research Service, Arlington, Va.
PHILIPS DEVELOPS MBE PROCESS FOR LASER, CHIP MANUFACTURE **c33**
In its West Europe Rept.: Sci. and Technol. (JPRS-CST-85-030) 28 Oct. 1985 p 38-39 Transl. into ENGLISH from Frankfurter Zeitung/Blick Durch die Wirtsch. (Frankfurt/Main), 6 Aug. 1985 p 5 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

Molecular beam epitaxy was used in manufacturing a special laser from gallium arsenide and aluminum gallium arsenide which operates at very short wavelengths of 707 nanometers. This has made it possible to achieve high electron mobility in a two dimensional electron gas. Precisely in the semiconductor industry, it is extremely important to control dimensions, makeup and purity of the materials used to achieve the required electrical properties. Epitaxial methods allow more precise operations in which the crystal layer intended for the electronic circuit is not subsequently bombarded with impurity atoms, but in which the operative crystal layer is built up to the desired structure slowly on a substrate. Molecular beam epitaxy with which layers can be grown by positioning of atoms is used. Using this method, molecular beams of the compound elements gallium, arsenic, aluminum, phosphorus and indium strike a heated substrate and are adsorbed there in layers. The growth rate and structure of the layer depend on the beam intensities. In this process, the molecular beams can also be switched on and off by using screens. Author

N86-13615# Joint Publications Research Service, Arlington, Va.
THOMSON SEMICONDUCTORS INTRODUCES PRODUCTS, BALANCES BOOKS **c33**
Roger Carrasco *In its* West Europe Rept.: Sci. and Technol.

(JPRS-CST-85-030) 28 Oct. 1985 p 40-42 Transl. into ENGLISH from Minis et Micros (Paris), 23 Sep. 1985 p 25 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

Product development at Thomson is discussed. Tono lines are featured. The VME line which consists of about 20 broads, plus software and systems. And the G64 line. Economic analysis and marketing strategy is also briefly discussed. E.R.

N86-13616# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY
8 Nov. 1985 49 p Repr. from various West European articles Transl. into ENGLISH from various West European articles (JPRS-WST-85-031) Avail: NTIS HC A03/MF A01

The FBIS West Europe Report (Science and Technology) of 8 November 1985 includes items in the following categories: Advanced Materials, the European Automobile Industry, Biotechnology, Civil Aviation, Computers, Microelectronics, and Scientific and Industrial Policy. Of special interest in this issue are articles on the Franco-Italian ATR-42 aircraft, new CMOS gate arrays produced at Thomson Semiconductors in France, the use of organo-metallic epitaxy to produce chips, and custom chips produced by European Silicon Structures. For individual titles, see N86-13617 through N86-13621.

N86-13617# Joint Publications Research Service, Arlington, Va.
CERTIFICATION GRANTED TO FRANCO-ITALIAN ATR 42 **c03**
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 10-13 Repr. from Rev. Aerospatiale (France), Oct. 1985 p 10; 12 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

The Franco-Italian (Aerospatiale/Aeritalia) ATR-42 commercial aircraft has been granted certification. The first production model was to be delivered in November 1985. The joint European venture expects to capture a generous share of the expected market (into the year 2000) of 2200 thirty-fifty and over 100 fifty-seventy passenger aircraft. F.M.R.

N86-13618# Joint Publications Research Service, Arlington, Va.
ATR 42 PRODUCTION WORK IN FRENCH, ITALIAN PLANTS DETAILED **c01**
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 14-19 Repr. from Rev. Aerospatiale (France), Oct. 1985 p 16; 18; 20; 22; 27 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

The ATR-42 passenger aircraft is to be a product of real international cooperation. The Franco-Italian aircraft is to be produced and assembled at three plants in France and one in Italy, with engines supplied by Pratt and Whitney of Canada. The composite wing tips, control surfaces and fairings will be manufactured at Aerospatiale in Nantes. Assembly, integration, and testing of the wing are to be subsequently carried out at the Aerospatiale plant in Sainte Nazaire. The engine nacelles are to be produced by Aerospatiale Meaulte. Manufacturing the fuselage and tail assembly will be the responsibility of Aeritalia in Naples, and final assembly will take place at Aerospatiale's Toulouse plant. Production of the larger version, the ATR-72, will be similarly apportioned. F.M.R.

N86-13619# Joint Publications Research Service, Arlington, Va.
NEW DIGITAL CIRCUITS AT THOMSON SEMICONDUCTOR IN FRANCE **c33**
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 27-29 Transl. into ENGLISH from Electron. Actualites (Paris), 15 Mar. 1985 p 1; 22 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

DCS, Thomson Semiconductors' Semi-Standard Circuits Department, has just announced a CMOS gate array with up to 4,200 gates, standard cells, and a unique 900-component, 3 GHz linear gate array. All of Thomson's gate arrays are supported by Daisy, Valid and Mentor workstations. These are the first fruits of a reorganization begun several months ago to distance the department from the actual design and manufacture of integrated circuits, making it more of an archestrator among customers, workstation manufacturers, independent designers and the various Thomson Semiconductors division. Thomson Semiconductors' silicon sales based on DCS contracts totaled 25,000,000 Frances in 1984. This figure should be double in 1985. Thomson Semiconductors plans to offer 120 new integrated circuits this year, twice the number available in 1984. At the same time, the Munich design center and the American subsidiary, VSI, should open new markets in 1985, bringing exports to an estimated 30 percent of sales. Author

N86-13620# Joint Publications Research Service, Arlington, Va.
CNET OF FRANCE USES ORGANO-METALLIC EPITAXY FOR LASER **c36**
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 8 Nov. 1985 p 30-31 Transl. into ENGLISH from Electron. Actualites (Paris), 22 Mar. 1985 p 26 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

CNET's Bagneux laboratory has just determine the characteristics of the first 1.3 microns GaInAsP laser chips produced by means of organo-metallic epitaxy on InP at atmospheric pressure. The results of the first complete after test (pulsed threshold current density of 1,200 A/sq cm at room temperature for laser 100 microns wide and 500 microns long; low feature dispersion, high quantity yield) are encouraging. They seem to indicate that with appropriate structures (for example, embedded ribbon lasers), it may be possible to construct direct current lasers that function at room temperature with threshold currents of 30 to 100 mA. The results are among the best in the world (CNET's threshold current is only 40% greater than the Thomson record achieved with a reduced-pressure organo-metallic epitaxial method) and are comparable to those recently publilshed by Bell Labs (3,600 A/sq cm at 1.36 microns, the first to have determined the characteristics of lasers made using the same method. Author

N86-13621# Joint Publications Research Service, Arlington, Va.
EUROPEAN SILICON STRUCTURES PLANS CUSTOM CHIPS IN 15 DAYS **c33**
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 35-41 Transl. into ENGLISH from Electron. Actualites (Paris), 6 Sep. 1985 p 1; 16 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

The European Silicon Structures group (called ES20 is about to enter into competition with the American and Japanese giants in the microelectronics field. ES2's goal is to supply or operate all the data-processing resources, in particular silicon compilers, required to design quickly full-custom circuits (exclusive of gate arrays and standard cells) from Paris, London and Munich by 1 Jan. 1986, to test the corresponding circuits in two weeks, using tooling tape, and then to produce them internally in series of up to a few ten thousand parts at competitive prices. F.M.R.

N86-13622# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY
30 Sep. 1985 74 p Transl. into ENGLISH from various West European articles
(JPRS-WST-85-029) Avail: NTIS HC A04/MF A01

Articles from western European publications on science and technology are briefly presented. Some broad areas covered are advanced materials, automobile industry, biotechnology, computers, factory automation, microelectronics, and technology transfer For individual titles, see N86-13623 through N86-13626.

N86-13623# Joint Publications Research Service, Arlington, Va.
RECENT ADVANCES IN COMPOSITE MATERIALS REVIEWED **c24**
Laurent Schwartz *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 1-2 Transl. into ENGLISH

from Ind. et Tech. (Paris), 10 Apr. 1985 p 18 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

Promises of increased productivity through the use of thermoplastic composites, continuous production, workshops with automatic monitoring are some ways the composites sector is looking for profitability, both at materials and at process level. Speakers at the European Symposium on Composites presented technical solutions likely to reduce production costs. Also included are shorter cycles with thermoplastic dies and stabilized thickening for polyester compounds. Author

N86-13624# Joint Publications Research Service, Arlington, Va.
NEW MATERIALS TO LIGHTEN VEHICLES
M. Castagna *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 6-11 Transl. into ENGLISH from Ing. Automotoristica (Turin), Mar. 1985 p 137-141 Presented at the 1st Inform. Seminar on Subproj. Road Transportation, Turin, 15-16 Nov. 1984 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

To evaluate the importance of proceeding with weight reduction work on the various components and subsystems of a vehicle, in terms of the economic balance between expected economies in fuel consumption and possible incremental production costs, a critical analysis was made of the data available in the technical literature, and criteria were identified for substitution of the materials. This study took into consideration, in addition to economic type parameters, also those parameters connected with manufacturing technologies and with design requirements provided indications as to the potential advantages and limits of weight reduction to be achieved through the use of high tensile steels, aluminum alloys, plastic materials including fiber reinforced ones, and plastic and metal laminates, with steel as well as with aluminum skins. Author

N86-13625# Joint Publications Research Service, Arlington, Va.
DIRECT INJECTION DIESEL MOTOR **c37**
R. Margary *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 18-31 Transl. into ENGLISH from Ing. Automotoristica (Turin), Mar. 1985 p 197-201 Presented at the 1st Inform. Seminar on Subproj. Road Transportation, Turin, 15-16 Nov. 1984 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

A single cylinder combustion concept for a direct injection automotive vehicle Diesel motor, yielding a substantial gain in fuel economy over the precombustion chamber solution with analogous performance ratings was studied. This was followed by the building of a definitive single cylinder prototype. An evaluation was also made of the advantages to be derived from the application of insulation techniques to the combustion chamber in the piston. Author

N86-13626# Joint Publications Research Service, Arlington, Va.
ITALIAN ROBOT MANUFACTURER ENTERS SPANISH MARKET **c37**
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 38-41 Transl. into ENGLISH from Rev. Robotica (Barcelona), May - Jun. 1985 p 27-30 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

Further developments in the utilization of robotics are discussed, especially as concerned with factory automation. The new robots include applications for assembly, loading and unloading, and palletization. The importance of applications engineering is briefly discussed, as are the plans for expansion in Spain. E.R.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-13627*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TESTING OF 30-GHz LOW NOISE RECEIVERS
Martin J. Conroy and Robert J. Kerczewski (Analex Corp.) [1985] 24 p refs Proposed for presentation at the 11th Annual Communication Satellite Systems Conference, San Diego, Calif., 16-20 Mar. 1986; sponsored by AIAA
(NASA-TM-87171; E-2809; NAS 1.15:87171) Avail: NTIS HC A02/MF A01 CSCL 20N

NASA-sponsored studies of the growth in communications traffic have indicated that the frequency spectrum allocated to fix-service satellites at the C and Ku bands will reach saturation by the early 1990's. The next higher frequency bands allocated for communications satellties are 27.5 to 30 GHz for the uplink and 17.7 to 20.2 GHz for the downlink. Current plans for developing satellite systems that use these bands include a NASA demonstration satellite (ACTS). One of the components identified as critical to the success of that mission is a 27.5 to 30 GHz satellite receiver. In response to that identification, NASA has sponsored the development of such a receiver to the proof-of-concept (POC) level. Design and fabrication of such POC model receivers was carried out under parallel contracts awarded to LNR Communications, Inc. of Hauppauge, New York and to ITT Defense Communications Division of Nutley, New Jersey. The most significant of the performance goals were a 5 db maximum noise figure, a 2.5 GHz passband, and e0 dB Rf to If gain. Following delivery of hardware from each of the contractors, an in-house test program was undertaken at NASA's Lewis Research Center in order to verify the contractor-reported performance and to provide a comparison of the two receivers under identical test conditions. The present paper reports the results of those tests. Author

N86-13628# Massachusetts Inst. of Tech., Lexington.
DISTRIBUTED SENSOR NETWORKS Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1984
R. T. Lacoss 30 Sep. 1984 32 p
(Contract F19628-85-C-0002; ARPA Order 3345; AF Proj. 5D30; AF Proj. 5T10)
(AD-A158033; ESD-TR-84-326) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report describes the work performed on the DARPA Distributed Sensor Networks Program at Lincoln Laboratory during the period 1 April through 30 September 1984. GRA

N86-13629# Massachusetts Inst. of Tech., Cambridge. Lab. of Electronics.
SPEECH RECOGNITION: ACOUSTIC, PHONETIC AND LEXICAL KNOWLEDGE Annual Progress Report, 1 Jul. 1984 - 30 Jun. 1985
V. W. Zue 5 Aug. 1985 310 p
(Contract N00014-82-K-0727; ARPA Order 4585)
(AD-A158264) Avail: NTIS HC A14/MF A01 CSCL 05/7

During this reporting period we continued to make progress on the acquisition of acoustic-phonetic and lexical knowledge. We completed development of a continuous digit recognition system. The system was constructed to investigate the use of acoustic-phonetic knowledge in a speech recognition system. The significant achievements of this study include the development of a soft-failure procedure for lexical access and the discovery of a set of acoustic-phonetic features for verification. We completed a study of the constraints that lexical stress imposes on word recognition. We found that lexical stress information alone can, on the average, reduce the number of word candidates from a large dictionary by more than 80 percent. In conjunction with this study, we successfully developed a system that automatically determines the stress

pattern of a word from the acoustic signal. We performed an acoustic study on the characteristics of nasal consonants and nasalized vowels. We have also developed recognition algorithms for nasal murmurs and nasalized vowels in continuous speech. We finished the preliminary development of a system that aligns a speech waveform with the corresponding phonetic transcription. GRA

N86-13630# Georgia Inst. of Tech., Atlanta.
AGILE ELECTROMAGNETICS EXPLOITING HIGH SPEED LOGIC (AEEHSL) Final Report, 1 Jul. 1982 - 30 May 1985
R. B. Efurd and J. M. Baden 1 Jul. 1985 39 p
(Contract N00014-82-K-0441)
(AD-A158380; GIT-A-3305-FTR) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report summarizes the research information that resulted from the program titled Agile Electromagnetic Exploiting High Speed Logic. The key points from this research are: (1) A polarization coded radar was built which performs pulse compression using a polarization code. (2) A Doppler insensitive pulse compression technique was demonstrated. (3) One hundred megahertz digital logic was implemented using conventional construction techniques. (4) Mismatched pulse compression codes were implemented which reduce both the peak and the average range-time sidelobes. and (5) Golay code paris were implemented which yielded zero range-time sidelobes for stationary target radar returns. GRA

N86-13631# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
CASSEGRAIN REFLECTOR SIDELOBE REDUCTION STUDY
H. E. King, S. Lazar, G. G. Berry, H. B. Dyson, and W. S. Wales 15 Jul. 1985 117 p
(Contract F04701-83-C-0084)
(AD-A158625; TR-0084A(5409-73)-1; SD-TR-85-39) Avail: NTIS HC A06/MF A01 CSCL 17/9

This report presents the results of a 4-month study to reduce the sidelobe levels of a 38 GHz, 2 ft diameter Cassegrain reflector. Both partial and full circumferential shrouds were added to the main reflector. Various shielding techniques to reduce the horn and subreflector radiation characteristics were evaluated. Measured primary patterns for the various horn-subreflector combinations were used to compute the secondary reflector patterns to evaluate the sidelobe improvement. The computed patterns were compared with measured results. GRA

N86-13632# La Jolla Inst., Calif. Center for the Study of Nonlinear Dynamics.
THEORETICAL STUDIES AND DATA ANALYSIS OF WAVE PROPAGATION IN RANDOM MEDIA Semiannual Technical Report, 1 Dec. 1984 - 31 May 1985
S. M. Flatte 15 Jun. 1985 152 p
(Contract MDA903-83-C-0515; ARPA Order 4852)
(AD-A158775; LJI-R-84-329) Avail: NTIS HC A08/MF A01 CSCL 17/2

The objective of this work is to develop a general theoretical framework for calculating fluctuations of signals on waves propagated through random media (WPRM) and to apply this framework to sound through the ocean; light through the atmosphere; radio waves through the ionosphere, solar wind, or interstellar plasma; and any other similar case of waves propagating through continuous media. Comparison with real data is an important aspect of the effort. The two most common signals sent on a carrier are the phase and amplitude of a nearly monochromatic wave. If enough bandwidth is available, one can send a pulse, and one can speak of the intensity and arrival time of that pulse. The technical problem is then to explain the statistical behavior of the intensity and arrival time in terms of medium fluctuations, where the medium is described statistically, usually by a power spectrum covering a large dynamic range of scales. Papers include: Equivalence of path Integral and Moment Equations in WPRM; Intensity Correlations--Solution for the fourth moment of WPRM; Unequal-Frequency Correlations--Two frequency intensity cross spectrum; The Scintillation Theory of Eclipse Shadow Bands. GRA

N86-13633# Random Applications, Inc., Montrose, Colo.
APPLICATIONS OF DIFFERENTIAL PHASE STATISTICS TO STUDIES OF C3 AND SPREAD SPECTRUM COMMUNICATIONS Final Report
R. F. Pawula 1985 4 p
(Contract F49620-83-C-0085)
(AD-A158815; AFOSR-85-0555TR) Avail: NTIS HC A02/MF A01 CSCL 17/2

Three reports have been written under this second year of the contract and are listed in the next section as Papers No. 6, 7, and 8. Paper No. 6 addresses the classical and very complicated problem of finding the probability density function at the output of an RC filter when the input is a binary random telegraph signal whose intervals are described by a renewal process. Paper No. 7 focuses on a particular case in which the desired probability density is the solution of a rather formidable third-order differential equation with non-constant coefficients. A closed form solution is found for one special value of a system characteristics parameter, and a series solution is obtained for general values of the this parameter. Paper No. 8 is concerned with developing methods for calculating the solution to a fourth order differential equation. Although the theory of such equations is well known, a prohibitive amount of algebra is required to determine the coefficients in series solutions, and a computer method is developed in which the algebra is circumvented. The method is quite general, and in an appendix is applied to Bessel's differential equation and, quite surprisingly, a new second solution to Bessel's equation is obtained which does not appear to have been previously noticed. GRA

N86-13634# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C.
SPECIALISTS MEETING ON ATOMIZATION AND NONDILUTE SPRAYS
D. M. Mann and J. M. Tishkoff 17 Jul. 1985 173 p Meeting held in Livermore, Calif., 20-21 Mar. 1985
(AD-A159006; AFOSR-85-0640TR) Avail: NTIS HC A08/MF A01 CSCL 21/4

A specialists meeting on atomization and nondilute spray behavior with 36 participants was held at Sandia National Laboratories, Livermore, California on 20-21 March 1985. Dilute sprays, nondilute sprays, atomization and measurement techniques each were discussed in two-hour topical sessions. Two subsequent discussion periods were used for general discussions and recommendations for future research. Twenty four recommendations were made. GRA

N86-13635# Naval Postgraduate School, Monterey, Calif.
CERENKOV RADIATION FROM PERIODIC BUNCHES FOR A FINITE PATH IN AIR M.S. Thesis
R. G. Bruce Jun. 1985 81 p
(AD-A159027) Avail: NTIS HC A05/MF A01 CSCL 20/7

The equation as derived by F.R. Buskirk and J.R. Neighbours for the power in the diffraction pattern of Cerenkov radiation from periodic bunches in air is experimentally tested at the Naval Postgraduate School Accelerator Laboratory (NPSAL). Previous experiments done at NPSAL are briefly reviewed. The experiment focuses on reducing RF noise and introduces a method for recording experimental data. RF noise is divided into two categories: (1) Noise received directly at the antenna; and (2) noise picked up by the cabling. Category 1 is divided into two subcategories: (a) Cerenkov radiation received by the antenna after being reflected off secondary objects; and (b) residual klystron radiation. Experimental data curves from the third harmonic are compared to theoretical patterns for various finite emission lengths and angle shifts. The data demonstrates tha noise-generated fine structure which appeared in a previous experiment at NPSAL can be eliminated with increased shielding. GRA

N86-13636# Naval Research Lab., Washington, D. C.
BABINET'S PRINCIPLE FOR AN ANISOTROPIC RESISTIVE SURFACE USING DIFFERENT APPROACHES
S. N. Samaddar 10 Sep. 1985 32 p
(AD-A159117; NRL-MR-5648) Avail: NTIS HC A03/MF A01

CSCL 20/3

Extension of Babinet's principle in electromagnetic theory to an inhomogeneous anisotropic (with non-zero off-diagonal terms) resistive sheet is made. Different methods are employed for this purpose so that a better understanding can be gained. Some basic properties of electromagnetic waves, such as odd and even symmetry, are also reviewed for clarity of presentation. GRA

N86-13637# Pacific Northwest Lab., Richland, Wash.
RADAR LOCATION EQUIPMENT DEVELOPMENT PROGRAM, PHASE 1
G. A. Sandness and K. C. Davis Jun. 1985 59 p refs
(Contract DE-AC06-76RL-01830)
(DE85-014523; PNL-5465) Avail: NTIS HC A04/MF A01

The first phase of a planned three-phase project designed to develop a radar system for monitoring waste canisters stored in a thick layer of bedded salt at the Waste Isolation Pilot Plant near Carlsbad, New Mexico is described. The canisters will be contained in holes drilled into the floor of the underground waste storage facility. The initial phase of this project was primarily a feasibility study. Its principal objective was to evaluate the potential effectiveness of the radar method in the planned canister monitoring application. Its scope included an investigation of the characteristics of radar signals backscattered from waste canisters, a test of preliminary data analysis methods, an assessment of the effects of salt and bentonite on the propagation of the radar signals, and a review of current ground-penetrating radar technology. Measurements were made to determine the signal propagation velocities in salt and bentonite (actually a bentonite/sand mixture) and to estimate the signal attenuation rate in the bentonite. A product survey and a literature search were made to identify available ground-penetrating radar systems and alternative antenna designs that may be particularly suitable for this unique application. DOE

N86-13638# Thomson-CSF, Velizy (France). Div. Tubes Electroniques.
THE DEVELOPMENT OF A SUBMILLIMETER WAVE CARCINOTRON OPERATING IN THE FREQUENCY RANGE FROM 850 TO 1000 GHz Final Report [DEVELOPPEMENT D'UN OSCILLATEUR LOCAL LEGER A CARCINOTRON FONCTIONNANT DANS LA BANDE 850-1000 GHZ]
L. Teyssier Paris ESA Dec. 1984 92 p refs In FRENCH; ENGLISH summary
(Contract ESTEC-4768/81/NL-HP)
(TDH-RT-2963-T; ESA-CR(P)-2041) Avail: NTIS HC A05/MF A01

An operating carcinotron device was assembled. It generates a minimal output power of 1 mW between 880 to 990 GHz. The maximum output power of 2.3 mW is reached at several points between 910 and 940 GHz. A mix-matrix tungsten-osmium cathode of 0.5 mm diameter was used. The high voltage range is between 4.9 kV and 8.8 kV, and the total power consumption is 192 W. Total weight 8.2 kg. The cooling is obtained by a 1.5 l/min water flow. For such a frequency range, the limiting factors of the output are the geometrical regularity and the quality of the slow wave structure manufacturing. Author (ESA)

N86-13639# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
ATMOSPHERIC RADIO NOISE: WORLDWIDE LEVELS AND OTHER CHARACTERISTICS
A. D. Spaulding and J. S. Washburn Apr. 1985 192 p
(PB85-212942; NTIA-85-173) Avail: NTIS HC A09/MF A01 CSCL 20N

There is a need for an overall, comprehensive usable noise model for application to telecommunication problems. One needed task that was accomplished toward the goal of obtaining such an overall model is the development of an improved atmospheric model The existing worldwide atmospheric noise model was developed from approximately 4 years of measurements from a worldwide network of 16 measurement stations. This network made measurements for 5 years (longer in a few cases) past the completion of CCIR Report 322 in 1963. Also, additional data are now available from other locations, primarily many years of data from 10 Soviet measurement stations. All these additional data was analyzed and an updated worldwide atmospheric noise model has been prepared in both graphical and numerical forms. Results of this analysis show substantial 'corrections; (on the order of 20 dB for some locations) to the 1MHz noise level values given by CCIR Report 322. This new model for atmospheric noise levels and other characteristics is presented and discussed.
Author (GRA)

N86-13640# Joint Publications Research Service, Arlington, Va.
WORLDWIDE REPORT: TELECOMMUNICATIONS POLICY, RESEARCH, AND DEVELOPMENT
25 Oct. 1985 50 p refs Transl. into ENGLISH from various worldwide articles
(JPRS-TTP-85-026) Avail: NTIS HC A03/MF A01

A general overview of a variety of policies and research and development efforts by various countries is presented. Most of the contents pertain to policy decisions of a general nature. For individual titles, see N86-13641 through N86-13641.

N86-13641# Joint Publications Research Service, Arlington, Va.
OPTIMAL TRANSFER FUNCTION FOR FIBER OPTIC COMMUNICATIONS
Zhou Shunqin *In its* Worldwide Rept.: Telecommun. Policy, Res. and Develop. (JPRS-TTP-85-026) 25 Oct. 1985 p 4-24 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 13, no. 2, Mar. 1985 p 11-12 (For primary document see N86-13640 04-32)
Avail: NTIS HC A03/MF A01

An approximation and realization method for an optimal transfer function for a full response digital optic fiber communications receiver is presented. It provides circuit types that approximate realization of an optimal transfer function for an optical receiver in an optic fiber communications system of low and high dispersion. A variable equalization circuit that allows an optical receiver to approximate an optimal transfer function for fiber optic lines of different bandwidth was constructed. A design example of a 1.3 micrometer, 34 Mb/s optical receiver designed with this method and the results of actual tests is presented. This receiver has already been put into operation with good results in an experimental optic fiber communications system with relays at 26.4 km and in the 13.6 km functional 34 Mb/s optic cable communications section built by the Wuhan Municipal Department of Telecommunications.
Author

N86-13602# Joint Publications Research Service, Arlington, Va.
SCHEME FOR HIGH-SPEED REAL-TIME DFT OPERATION FOR RADAR SIGNAL PROCESSING
Su Yanguang and Shi Xingrong *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 65-69 ref Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 12, no. 1, Jan. 1984 p 113-115 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-13608# Joint Publications Research Service, Arlington, Va.
IMPROVED ALGORITHM FOR RADAR REAL-TIME DATA PROCESSING
Zhang Zhiben *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 105-108 Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 13, no. 1, Jan. 1985 p 127-128 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-13790# Joint Publications Research Service, Arlington, Va.
OBSERVATION OF OPTICAL-RADIO FREQUENCY RESONANCE IN H2O USING WIDE-BAND RUBY LASER SPECTROSCOPY Abstract Only
V. P. Kochanov, V. P. Lopasov, and S. F. Lukyanenko *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 37 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 516-520 Original language document was announced in IAA as A85-31864 (For primary

document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14105*# East Texas State Univ., Commerce. Dept. of Computer Science.
SIGNAL PROCESSING OF ANTHROPOMETRIC DATA Final Report
Wayne J. Zimmermann *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-13642 Massachusetts Univ., Amherst.
NUMERICAL MODELING OF CARRIER TRANSPORT IN SUBMICRON BIPOLAR TRANSISTORS Ph.D. Thesis
Phung Thien Nguyen 1985 110 p
Avail: Univ. Microfilms Order No. DA8509583

The transport of electrons in submicron bipolar junction transistor (BJT) structures was investigated using the Monte Carlo (MC) method coupled with the conventional drift diffusion equations (DDE). The nonstatic velocity overshoot in the base region of different BJT structures was studied. Specification of the boundary conditions for the MC regional calculations is described. The transit time through the base and collector spacecharge regions is computed using alternately the DDE and MC techniques. The DDE and MC results were compared to demonstrate the effect of velocity overshoot. The switching behavior to different BJT designs was analyzed to illustrate factors that control the switching speed in BJT's. The effects of electron-electron (e-e) scattering in a single particle MC approach and the effects of e-e scattering on the average electron velocity and the velocity distribution are studied. Dissert. Abstr.

N86-13643*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VERIFICATION OF COMPUTER-AIDED DESIGNS OF TRAVELING-WAVE TUBES UTILIZING NOVEL DYNAMIC REFOCUSERS AND GRAPHITE ELECTRODES FOR THE MULTISTAGE DEPRESSED COLLECTOR
Peter Ramins, Henry G. Kosmahl, Dale A. Force, Raymond W. Palmer, and James A. Dayton, Jr. Oct. 1985 26 p refs
(NASA-TP-2524; E-2566; NAS 1.60:2524) Avail: NTIS HC A03/MF A01 CSCL 09A

A computational procedure for the design of TWT-refocuser-MDC systems was used to design a short dynamic refocusing system and highly efficient four-stage depressed collector for a 200-W, 8- to 18-GHz, TWT. The computations were carried out with advanced, multidimensional computer programs which model the electron beam as a series of disks of charge and follow their trajectories from the RF input of the TWT, through the slow-wave structure and refocusing section, to their points of impact in the depressed collector. Secondary emission losses in the MDC were treated semi-quantitatively by injecting a representative beam of secondary electrons into the MDC analysis at the point of impact of each primary beam. A comparison of computed and measured TWT and MDC performance showed very good agreement. The electrodes of the MDC were fabricated from a particular form of isotropic graphite that was selected for its low secondary electron yield, ease of machinability, and vacuum properties. This MDC was tested (at CW) for more than 1000 hr with negligible degradation in TWT and MDC performances. Author

N86-13644*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LINEARITY OPTIMIZATION IN A CLASS OF ANALOG PHASE MODULATORS
Chase P. Hearn Nov. 1985 24 p refs
(NASA-TM-86420; L-15982; NAS 1.15:86420) Avail: NTIS HC A02/MF A01 CSCL 04A

This paper examines the ultimate modulating linearity attainable with a phase modulation technique based on the linear addition of quadrature phase carrier signals which have been multiplied by precisely defined nonlinear transformations of the modulating signal. Optimum gain coefficients are derived and plotted to permit implementation of analog phase modulators capable of exceptionally good linearity of phase deviations as large as 5 radians. Author

N86-13645*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL FOR USE OF INDIUM PHOSPHIDE SOLAR CELLS IN THE SPACE RADIATION ENVIRONMENT
I. Weinberg, C. K. Swartz, and R. E. Hart, Jr. 1985 9 p refs Presented at the 18th Photovoltaic Specialists Conference, Las Vegas, Nev., 21-25 Oct. 1985; sponsored by IEEE
(NASA-TM-87157; E-2785; NAS 1.15:87157) Avail: NTIS HC A02/MF A01 CSCL 09C

Indium phosphide solar cells were observed to have significantly higher radiation resistance than either GaAs or Si after exposure to 10 MeV proton irradiation data and previous 1 MeV electron data together with projected efficiencies for InP, it was found that these latter cells produced more output power than either GaAs or Si after specified fluences of 10 MeV protons and 1 MeV electrons. Estimates of expected performance in a proton dominated space orbit yielded much less degradation for InP when compared to the remaining two cell types. It was concluded that, with additional development to increase efficiency, InP solar cells would perform significantly better than either GaAs or Si in the space radiation environment. Author

N86-13646# Department of the Air Force, Washington, D.C.
PHASE LOCK ACQUISITION SYSTEM Patent Application
S. P. Caldwell, inventor (to Air Force) Filed 6 Jun. 1984 19 p
(AD-D011804; US-Patent-Appl-SN-617668) Avail: NTIS HC A02/MF A01 CSCL 09/5

The acquisition of phase lock to a reference frequency by a signal acquisition system is accomplished using a voltage controlled oscillator, a wideband frequency discriminator, a prepositioning circuit, and a phase lock loop. The voltage controlled oscillator is prepositioned within a loop bandwidth of the reference frequency by the preposition circuit and the wide band frequency discriminator which provide coarse turning. The voltage controlled oscillator achieves phase lock with the reference frequency when it receives the fine tune signal from the phase lock loop. Using total the discriminator and the phase look loop allows fast acquisition without the need to calibrater the voltage controlled oscillator. Since the discriminator pull-in range is much larger than the phase-lock loop bandwidth, the number of bits can be much smaller than in an acquisition circuit using a digital prepositioning circuit alone. GRA

N86-13647# Department of the Army, Washington, D. C.
CATHODE INCLUDING A NON FLUORINATED LINEAR CHAIN POLYMER AS THE BINDER, METHOD OF MAKING THE CATHODE, AND LITHIUM ELECTROCHEMICAL CELL CONTAINING THE CATHODE Patent Application
E. J. Plichta and M. Salomon, inventors (to Army) Filed 27 Jun. 1985 11 p
(AD-D011807; US-Patent-Appl-SN-749597) Avail: NTIS HC A02/MF A01 CSCL 10/3

Existing technology for the fabrication of cathodes for use in lithium primary and secondary cells utilizes Teflon as the binding material. Teflon or polytetrafluoroethylene is expensive though inert, and its use results in cathode structures of poor mechanical stability. These problems do not easily lend themselves to the large scale production of cathodes in manufacturing. This patent

application pertains to a cathode suitable for use in a lithium electrochemical cell. It is made from a mixture of active cathode material, carbon, and non fluorinated linear chain polymer by a method including the steps of: (1) dissolving the non fluorinated linear chain polymer in a non polar solvent at a temperature near the melting point of the polymer; (2) adding the active cathode material and carbon and evaporating the solvent; and (3) grinding the dried mixture into a fine powder and making it into a cathode by pressing the powdered mixture onto both sides of an expanded metal screen and then cutting to the desired dimensions. The cathode can be combined with lithium as the anode and a solution of 0.8 mol 3/dm LiAlCl4 in a mixed organic solvent of 24 mass percent 4-butyrolactone in 1, 2 dimethoxyethane as the electrolyte to provide a mechnically stable, relatively inexpensive lithium electrochemical cell having good cell performance. GRA

N86-13648# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
TRANSIENT SIMULATION OF SUBMICRON DEVICES Interim Report
Th. G. VandeRoer and S. C. Van Someren Greve 2 Jul. 1985 6 p
(Contract DAJA45-84-C-0054)
(AD-A157748; R/D-4663-EE-01; IR-2) Avail: NTIS HC A02/MF A01 CSCL 09/1

Previously the Legendre-Hermite polynomial expansion of Boltzmann's equation (1) has been used to calculate the velocity-field characteristic of InP at room temperature (2). In this report application of the method to a millimetre wave InP Gunn diode is described. Author (GRA)

N86-13649# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
USING SOFTWARE TECHNOLOGY TO SPECIFY ABSTRACT INTERFACES IN VLSI DESIGN Ph.D. Thesis
R. R. Gross 1985 156 p
(AD-A158034; AFIT/CI/NR-85-92D) Avail: NTIS HC A08/MF A01 CSCL 09/5

Good techniques for VLSI design change management do not now exist. A principal reason is the absence of effective methods for the specifications of abstract interfaces for VLSI designs. This dissertation presents a new approach to such specification, an approach that extends to the VLSI domain D.L. Parnas's techniques for precise specification of abstract software design interfaces to the VLSI domain. The proposed approach provides important new features, including scalability to VLSI design levels, integration into the design life-cycle, and a uniform treatment of functional, electrical, and geometric design information. A technique is also introduced for attaching a value to the degree of specification adherence of a candidate module. To illustrate and evaluate the proposed approach, an example specification method using it is described and evaluated experimentally. Author (GRA)

N86-13650# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
BULK CMOS VLSI TECHNOLOGY STUDIES. PART 4: DESIGN OF A CMOS MICROSEQUENCER Final Report, Aug. 1982 - Feb. 1985
J. D. Trotter and G. S. Prasad 17 Jun. 1985 216 p
(Contract DAAG29-82-K-0167)
(AD-A158369; ARO-19839.1-EL-A-Pt-4) Avail: NTIS HC A10/MF A01 CSCL 09/5

This thesis discusses the design of a CMOS microsequencer used in a microprogrammed control organization. A preconceived data path performs most of the data manipulation functions for an LSI computer system. The operations are performed as directed by sequences of control microinstructions, which are fetched from a microcode memory using addresses generated by the microsequencer chip. A Programmable Logic Array (PLA) is selected in lieu of random logic to control the circuits within the microsequencer. Extensive use has been made of clocked CMOS over classic CMOS to achieve higher layout density and better performance. The chip has been designed using scalable design rules which means it can be fabricated in 1.2 micron or 3 micron technology. The design used double-layer metal, eliminating the need for extensive poly-interconnect lines. Author (GRA)

N86-13651# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
BULK CMOS VLSI TECHNOLOGY STUDIES. PART 5: THE DESIGN AND IMPLEMENTATION OF A HIGH SPEED INTEGRATED CIRCUIT FUNCTIONAL TESTER Final Report, Aug. 1982 - Feb. 1985
J. D. Trotter and H. D. Robbins 17 Jun. 1985 185 p
(Contract DAAG29-82-K-0167)
(AD-A158370; ARO-19839.1-EL-A-Pt-5) Avail: NTIS HC A09/MF A01 CSCL 14/2

This thesis project discusses the design and implementation of a functional tester to be used in a university laboratory facility for integrated circuit development. The following tester capabilities were desired: (1) 100KHz - 10 MHz Test Frequency, (2) 2K x 64Bit Test Vector Size, (3) Four User Programmable Clocks, (4) Test Vector Input using High-Level Language, and (5) Test Data Manipulation Using a High-Level Language. The functional tester receives test vector data from a Hewlett Packard HP9920A computer and loads this data into functional tester buffer memory. After the data is down-loaded, including certain operational information such as a test clock frequency, programmable clock waveform information, data direction control, etc., the tester initiates the test using random-logic control circuitry to achieve the desired high speeds. The random-logic control circuitry indicates the completion of the test, at which time the resultant data, stored in buffer memory, is up-loaded to the HP9920A for processing. This design approach to a functional tester for laboratory use differs from and improves upon previous methods, in that random-logic control circuitry is used during the test phase to provide greater operating speeds than systems which use microprocessor-control for the complete test. GRA

N86-13652# California Univ., Berkeley. Electronics Research Lab.
JOINT SERVICES ELECTRONICS PROGRAM Annual Report, 1 May 1984 - 28 Feb. 1985
W. G. Oldham 30 Apr. 1985 11 p
(Contract F49620-84-C-0057)
(AD-A158731; UCB/ERL-85-1; AFOSR-85-0669TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

An annual report of the JSEP (Joint Services Electronics Program) in Electromagnetics, Solid State Electronics, Materials and Devices, Quantum Electronics and Information Sciences is presented. In addition, results of the research to date are summarized and significant accomplishments are indicated. GRA

N86-13653# Naval Postgraduate School, Monterey, Calif.
MeV ELECTRON BEAM IRRADIATION EFFECTS ON GaAs (1-x) P (x) LEDS (LIGHT EMITTING DIODES) M.S. Thesis
J. K. Foley Jun. 1985 98 p
(AD-A158832) Avail: NTIS HC A05/MF A01 CSCL 09/1

LEDs of the ternary alloy GaAs(.7)P(.3), were irradiated with a 30 MeV electron beam. The effects this exposure had on peak wavelength, absolute and relative light output intensities, and current-forward bias characteristics were studied. A simple model of LED current controlling mechanisms is described and a mathematical approach for deriving a descriptive damage-constant is provided. Observed irradiation effects consisted of increased current and decreased light output intensity for a given forward bias voltage and indicate that the devices tested are an order of magnitude softer to electron radiation than results previously reported. Damage constants were calculated: group 9 (290 to the -14h power sq cm/e), group A5 (260 to the -14th power sq cm/e), and group 3 (140 to the -14th power sq cm/e). Shielded and un-shielded devices were compared to determine if the secondary electron production for Bremsstrahlung losses would reduce the total fluence required for degradation. The results of this experiment were inconclusive. A procedure was developed to determine the electron beam current density for use in dose estimations. Electron

doses were a factor of three higher when compared to the previous method of calculation. GRA

N86-13654# Stanford Univ., Calif. Lab. of Physics.
JOINT SERVICES ELECTRONICS PROGRAM Annual Progress Report, 1 Apr. 1984 - 31 Mar. 1985
S. E. Harris, D. M. Bloom, R. L. Byer, G. S. Kino, and C. F. Quate 15 Jul. 1985 62 p
(Contract N00014-84-K-0327)
(AD-A158840; GL-3891; APR-1) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report is the Annual Progress Report for Joint Services Electronics Program Contract N00014-84-K-0327 for the Faculty of the Edward L. Ginzton Laboratory of Stanford University (S.E. Harris, Director). The report includes contributions on four units: (1) (Unit 85-1: Processor D.M. Bloom) Picosecond Optical Measurements; (2) Unit 85-2: Processor R.L. Byer) Optical and Nonlinear Optical Studies of Single Crystal Fibers; (3) (Unit 85-3: Professor G.S. Kino) Very High Frequency Signal Processing Techniques; (4) Unit 85-4: Professor C.F. Quate) Metal-Vacuum-Metal Tunneling or scanned Tunneling Microscopy. Author (GRA)

N86-13655# Wisconsin Univ., Madison. Dept. of Chemistry.
LUMINESCENT PROPERTIES OF SEMICONDUCTOR ELECTRODES
A. B. Ellis 15 Aug. 1985 134 p
(Contract N00014-78-C-0633)
(AD-A158841; UWIS/DC/TR-85/2) Avail: NTIS HC A07/MF A01 CSCL 09/1

The literature regarding photoluminescence and electroluminescence from semiconductor electrodes is reviewed. GRA

N86-13656# Battelle Pacific Northwest Labs., Richland, Wash.
ELECTRICAL AND THERMAL TRANSPORT PROPERTY STUDIES OF HIGH-TEMPERATURE THERMOELECTRIC MATERIALS Interim Technical Report, 15 May 1984 - 15 May 1985
J. L. Bates, C. W. Griffin, W. J. Weber, and L. C. Olsen Jun. 1985 73 p
(Contract F49620-83-C-0109)
(AD-A158883; AFOSR-85-0723TR) Avail: NTIS HC A04/MF A01 CSCL 20/12

The research effort during this reporting period has continued to emphasize the study of electronically conducting oxides, which was initiated in the previous reporting period. The high-temperature transport property data base has been expanded by continued measurements in several systems under study, and a theoretical model for thermoelectric properties based on a small polaron transport has been developed. The study of the transport properties of the In2O3-SnO2 system, which was initiated during the previous reporting period, has been completed. Low values for the figure of merit were obtained, as expected, for these degenerate-type semiconductors. Some high-temperature materials that exhibit high figures of merit were seen. The theoretical model developed under this program predicts that narrow-band semiconductors with small polaron hopping along inequivalent sites of distorted sublattices can result in increases in both electrical conductivity and Seebeck coefficient with temperature without significant increases in thermal conductivity. High figures of merit, greater than 1.0 at 1000 K, that increases with temperature are predicted by the model. The model is being applied to the divalent metal-doped (Y, La)CrO3 systems with the ABO3 perovskite structure. Transport property data obtained during this reporting period for different divalent metal dopants at different concentrations are being used to evaluate the model. GRA

N86-13657# California Univ., Berkeley. Lawrence Radiation Lab. Electronics Research Lab.
DEVELOPMENT OF HIGH SENSITIVITY X-RAY AND ELECTRON BEAM RESIST PROCESSES Final Technical Report, 15 Dec. 1979 - 29 Jan. 1985
D. W. Hess May 1985 27 p
(Grant AF-AFOSR-80-0078)
(AD-A158968; AFOSR-85-0738TR) Avail: NTIS HC A03/MF A01 CSCL 09/5

The lithographic performance of a polymer resist material is determined by several processes. First, uniform and controllable films of the resist must be reproducibly applied to the surface of substrates. Second, the radiation/polymer interaction is important since it affects the sensitivity of the resist. Third, the development or dissolution process is crucial because this step determines the ability to create useable patterns in the resist film. Finally, for Very Large Scale Integration (VLSI), dry etching processes are replacing liquid techniques; thus, the interaction of resists with glow discharges can often determine the utility of specific materials. Under AFOSR Grant 80-0078, various aspects of the above criteria were studied in order to gain fundamental understanding of these important process steps. GRA

N86-13658# Department of the Navy, Washington, D. C.
GAS RECIRCULATOR FOR ACYCLIC MACHINES Patent Application
T. F. Balsa, inventor (to Navy) Filed 28 May 1985 9 p
(AD-D011873; US-Patent-Appl-SN-737753) Avail: NTIS HC A02/MF A01 CSCL 10/2

The present invention relates to acyclic machines of the type using liquid metal collectors, and more particularly to an improvement for retaining the liquid metal in such machines. Radial type acyclic motors and generators generally include a metallic disk rotor rotating on a shaft between electromagnetic stator poles excited by field coils wound concentric with the shaft. Instead of solid brush, current collectors at the rotor periphery, liquid metal collectors are sometimes used to close the electrical current loop between the shaft and the rotor, and an inert pressurized cover gas fills the gaps between the rotating components and the stationary housing. A cover has recirculator in an acyclic generator having liquid metal collectors for reducing entrainment of the liquid metal in the gas. Radial passages in the stator housing provide natural recirculating paths for the cover gas to flow radially outward along the sides of the rotor and return inwardly through the passages. Scoops or lips located inward of the liquid metal collector divert the outward gas flow into the passages to minimize contact of the gas with the liquid metal. GRA

N86-13659# Department of the Navy, Washington, D. C.
ATOMICALLY MIXED ALLOY COATED CATHODES SPECIFICATION Patent Application
G. A. Haas, A. Shih, and C. R. K. Marrian, inventors (to Navy) Filed 4 Apr. 1985 20 p
(AD-D011877; US-Patent-Appl-SN-719403) Avail: NTIS HC A02/MF A01 CSCL 09/1

The present invention pertains generally to cathodes used in thermionic electron tubes, often used in ultra high frequency and microwave radio transmitters. It is an object of this invention to produce thermionic tube cathodes which consistntly exhibit current densities higher than heretofore achieved. Another object of the present invention is to manufacture cathodes using a method that consistently results in cathodes with a large, defined, level of current density. Another object of the present invention is to produce cathodes with reduced surface work functions by means of atomic scale mixing of two selected metals in a cathode surface coating. A tungsten or tungsten-based matrix cathode impregnated with BaO is simultaneously coated with vapors of two metallic elements, in particular, tungsten and iridium, such that a binary alloy forms on the surface. A layer of BaO then spontaneously dispenses onto the surface of the binary alloy. One of the metallic elements associates with the oxygen of BaO and other with the barium. The molecular dipole of BaO thus becomes more pronounced, and the surface work function results in a greater rate of electron emission from the cathode. GRA

N86-13660# Department of the Army, Washington, D. C.
ANALOG-TO-DIGITAL CONVERTER Patent Application
C. E. Konig and W. J. Skudera, Jr., inventors (to Army) Filed 16 Aug. 1985 21 p
(AD-D011878; US-Patent-Appl-SN-766371) Avail: NTIS

HC A02/MF A01 CSCL 09/5

An apparatus is disclosed which permits a high speed waveform, for example in the form of a series of analog data pulses, to be sampled and converted into a series of digital values. Each analog data pulse is applied in parallel to a multiplicity of A/D converters and to one or more level detectors. Each level detector provides a strobe when the voltage of the analog data pulse crosses a reference threshold. The strobes are applied to delay means whose outputs are a multiplying of delayed strobe pulses which have been delayed by predetermined amounts. Each of the multiplicity of A/D converters samples the analog data pulse in response to the particular delayed strobe applied thereto and provides a digital value of that sample. The largest of the digital values from each of the A/D converters is provided as the output of the apparatus for each analog data pulse. GRA

N86-13661# Department of the Army, Washington, D. C.

SLOT LINE TUNABLE BANDPASS FILTER Patent Application

E. A. Mariani and R. A. Stern, inventors (to Army) Filed 7 Aug. 1985 36 p

(AD-D011881; US-Patent-Appl-SN-763161) Avail: NTIS HC A03/MF A01 CSCL 09/5

A tunable bandpass filter comprising a pair of slot line resonant cavities formed in a metallic film covering the planar surface of a ferrite substrate is studied. A magnetic biasing field of variable magnitude is generated and applied through the ferrite substrate transversely across the slot line resonant cavities. The magnetic field operates to change the electrical length of the resonant cavities due to the fact that the magnetic permeability of the ferrite material changes with the applied field. Author (GRA)

N86-13662# Department of the Army, Washington, D. C.

CATHODE FOR USE IN HIGH ENERGY PRIMARY THIONYL CHLORIDE CELL SYSTEMS AND HIGH ENERGY PRIMARY THIONYL CHLORIDE CELL SYSTEMS INCLUDING THE CATHODE Patent Application

C. W. Walker, Jr., W. L. Wade, Jr., M. Binder, and S. Gilman, inventors (to Army) Filed 22 Aug. 1985 9 p

(AD-D011882; US-Patent-Appl-SN-768271) Avail: NTIS HC A02/MF A01 CSCL 09/1

A cathode is provided for use in high energy primary lithium-thionyl chloride cell systems or calcium-thionyl chloride cell systems. The cathode comprises an expanded metallic current collector screen into which has been pasted a mixture of a low surface area conductive carbon black and a high surface area conductive carbon black previously mixed with a binder. GRA

N86-13663# Los Alamos National Lab., N. Mex.

A 10-MHz HIGH-VOLTAGE MODULATOR WITH PULSE-WIDTH AND REPETITION-RATE AGILITY

G. J. Krausse 1985 7 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985

(Contract W-7405-eng-36)

(DE85-014117; LA-UR-85-2057; CONF-850616-58) Avail: NTIS HC A02/MF A01

Requirements for control and rapid switching of the proton beam at the Los Alamos Meson Physics Facility (LAMPF) are continually revised to support accelerator upgrades and modifications. A recent upgrade required the development of a 10-MHz high-voltage modulator for an electrostatic kicker with real-time control of pulse width and repetition rate over a range of four decades. The modulator must be capable of producing a voltage pulse across a capacitive load with a rise time of less than or equal to 20 ns (10% to 90%). In addition the falling edge undershoot must be controlled to less than one part in 10(3). The paper describes in detail the circuit design philosophy, layout, and critical areas in system design. DOE

N86-13664# Oak Ridge National Lab., Tenn.

COMPARISON OF ION MILLING TECHNIQUES FOR CROSS-SECTIONAL TEM OF SEMICONDUCTORS

J. T. Luck, C. W. Boggs, and S. J. Pennycook Mar. 1985 3 p Presented at the Joint Meeting of the Electron Microscopy Soc. of Am. and the Microbeam Anal. Soc., Louisville, Ky., 5 Aug. 1985

(Contract DE-AC05-84OR-21400)

(DE85-016596; CONF-850840-16) Avail: NTIS HC A02/MF A01

The use of cross-sectional Transmission Electron Microscopy (TEM) has become invaluable for the characterization of the near-surface regions of semiconductors following ion-implantation and/or transient thermal processing. A fast and reliable technique is required which produces a large thin region while preserving with the original sample surface. New analytical techniques, particularly the direct imaging of dopant distributions, also require good thickness uniformity. Two methods of ion milling are commonly used, and are compared. The older method involves milling with a single gun from each side in turn, whereas a newer method uses two guns to mill from both sides simultaneously. DOE

N86-13665# Argonne National Lab., Ill.

MICROCOMPUTER CONTROLLED CURRENT SHARING EXPERIMENTS WITH PARALLEL CONVERTERS

R. L. Kustom and J. J. Skiles 1985 5 p Presented at the IEEE-Ind. Appl. Soc. Ann. Meeting, Toronto, 6 Oct. 1985 Prepared in cooperation with Wisconsin Univ., Madison

(Contract W-31-109-eng-38)

(DE85-013854; ANL-HEP-CP-85-61; CONF-851071-2) Avail: NTIS HC A02/MF A01

Power conditioning circuits for a Superconductive Magnetic Energy Storage (SMES) coil will require many parallel SCR devices because the operating current is planned to be as high as a few hundred thousand amperes. In order to maintain current balance in the parallel units, a microcomputer controlled system that adjusts the delay angle of individual units is envisioned. Studies and tests on an 8-H model with two parallel 9 kVA bridge circuits are described. DOE

N86-13666# Oak Ridge National Lab., Tenn.

ELECTRICAL SLIDING JOINT LITERATURE REVIEW (VIEWGRAPH PRESENTATION)

G. E. Gorker and S. S. Kalsi 14 Mar. 1985 12 p Presented at the Workshop on High Current Elec. Joints for Tokamaks, Princeton, N.J., 14 Mar. 1985

(Contract DE-AC05-87OR-21400)

(DE85-011571; CONF-8503144-1) Avail: NTIS HC A02/MF A01

This survey covers the following sliding joint options: (1) multilam joints, (2) finger joints, (3) wire brushes, (4) composite copper/graphite brushes, and (5) joint performance at low temperatures. DOE

N86-13667# Illinois Univ., Urbana. Dept. of Ceramic Engineering.

OXIDE ELECTRODES AT HIGH TEMPERATURES

G. P. Wirtz and H. S. Isaacs 1984 5 p Prepared in cooperation with BNL, Upton, N.Y.

(Contract DE-AC02-76CH-00016)

(DE85-006564; BNL-35567) Avail: NTIS HC A02/MF A01

Models and conclusions which aid in the design of high temperature electrodes are presented. DOE

N86-13668# Societe Europeenne de Propulsion, Vernon (France). Space Dept.

ELECTRICAL MOTOR WITH SUPERCONDUCTING WINDING Final Report

J. P. Bugeat and R. Petit Paris ESA 15 Jan. 1985 116 p

(Contract ESTEC-5609/83)

(SEP-TS/SE/BT/10026/85; ESA-CR(P)-2042) Avail: NTIS HC A06/MF A01

The winding of an electrical motor tested under vaccum and at cryogenic temperature (10K) was modified. The niobium-titanium copper wire used allows the motor to run from room temperature to liquid helium temperature. Under the transition temperature (9.5K) heat dissipation in the coil is 0 whereas in a copper wound motor this dissipation is 30 mW. The motor sustained a complete test program including: functional test including torque

measurement at cryogenic temperature; endurance test: 750,000 turns performed; environment test: vibration test at qualification level at cryogenic temperature. The tests reveal no degradation of mechanical (plays, friction torque) or electrical (transition temperature) performances. Author (ESA)

N86-13568# Rasor Associates, Inc., Sunnyvale, Calif.
CLOSE-SPACE, HIGH TEMPERATURE KNUDSEN FLOW Abstract Only
John B. McVey *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13603# Joint Publications Research Service, Arlington, Va.
ON H PLANE DIELECTRIC LOADING THEORY FOR H PLANE FERRITE PHASE SHIFTER
Wen Junding *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 70-75 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing), v. 12, no. 1, Jan. 1984 p 116-119 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-13612# Joint Publications Research Service, Arlington, Va.
THOMSON, CNET OF FRANCE IN SILICON-ON-INSULATOR RESEARCH
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 28 Oct. 1985 p 34-36 Transl. into ENGLISH from Electron. Actualites (Paris), 8 Mar. 1985 p 1 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

N86-13614# Joint Publications Research Service, Arlington, Va.
PHILIPS DEVELOPS MBE PROCESS FOR LASER, CHIP MANUFACTURE
In its West Europe Rept.: Sci. and Technol. (JPRS-CST-85-030) 28 Oct. 1985 p 38-39 Transl. into ENGLISH from Frankfurter Zeitung/Blick Durch die Wirtsch. (Frankfurt/Main), 6 Aug. 1985 p 5 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

N86-13615# Joint Publications Research Service, Arlington, Va.
THOMSON SEMICONDUCTORS INTRODUCES PRODUCTS, BALANCES BOOKS
Roger Carrasco *In its* West Europe Rept.: Sci. and Technol. (JPRS-CST-85-030) 28 Oct. 1985 p 40-42 Transl. into ENGLISH from Minis et Micros (Paris), 23 Sep. 1985 p 25 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

N86-13619# Joint Publications Research Service, Arlington, Va.
NEW DIGITAL CIRCUITS AT THOMSON SEMICONDUCTOR IN FRANCE
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 27-29 Transl. into ENGLISH from Electron. Actualites (Paris), 15 Mar. 1985 p 1; 22 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

N86-13621# Joint Publications Research Service, Arlington, Va.
EUROPEAN SILICON STRUCTURES PLANS CUSTOM CHIPS IN 15 DAYS
J. P. DellaMussia *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-031) 8 Nov. 1985 p 35-41 Transl. into ENGLISH from Electron. Actualites (Paris), 6 Sep. 1985 p 1; 16 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-13669 California Univ., Berkeley.
A STUDY OF TRANSPORT PHENOMENA AND INTERFACE STABILITY DURING SOLIDIFICATION OF BINARY SOLUTIONS USING FRONT TRACKING FINITE ELEMENTS
Hai-Lung Tsai 1984 191 p
Avail: Univ. Microfilms Order No. DA8513017

A new numerical method using front tracking finite elements is developed to solve the multidimensional transient heat and mass transfer equations associated with the solidification of binary solutions. The energy balance equation at the interface is not treated as a boundary condition, but rather as an independent equation whose solution gives the new position of the interface. A special new method is developed to which the interface is tracked in time by two steps: first the magnitude of displacement and the normal direction are independently obtained for each node on the interface, then they are superimposed to determine the new interface position. The numerical method can incorporate realistic thermodynamic conditions on the interface (including the effects of interfacial tension) and can accommodate the nonisothermal as well as the irregular but smooth interface. A novel meshing system based on a systematic exponential gridding concept is developed to yield accurate temperatures in the solid and liquid phases and concentration distribution in the liquid. This numerical method is then employed to study the transport phenomena as well as the morphological stability of a planar interface during a solidification process in a saline solution. Author

N86-13670 Northwestern Univ., Evanston, Ill.
PROBLEMS IN THERMAL CONVECTIVE INSTABILITY Ph.D. Thesis
Michael Roppo 1985 216 p
Avail: Univ. Microfilms Order No. DA8511852

Three problems related to convective instabilities in which buoyancy is a fluid driving force are considered. This buoyancy is produced by imposed temperature gradients across the fluid and is measured by a Rayleigh number. The first problem considers a convection layer heated from below in a time-periodic manner with fluctuations of small amplitude delta. The nonlinear theory is studied by perturbation theory in the neighborhood of the onset of convection. It is shown that the critical Rayleigh number for the onset of convection is increased by an amount sq delta. The second problem is the flow of a fluid in thermosyphons, thin closed loops. The effects of coupling on the steady and unsteady dynamics of the loops was investigated. It is found that the coupling can delay instabilities and the onset of chaos but can give rise to new states that alter the symmetries of the flow. A two-dimensional problem which exhibits free surface driving forces in addition to buoyancy was studied. Amplitude equations for the nonlinear problem are generated by series truncation methods generalizing to free surface problems. Dissert. Abstr.

N86-13671 Wisconsin Univ., Madison.
NON-NEWTONIAN FLOW PAST CURVED EXTERNAL SURFACES Ph.D. Thesis
Nancy Joy D. E. Lambert 1984 143 p
Avail: Univ. Microfilms Order No. DA8511980

The principle motivation of this research is the creation of a foundation for predicting resistance to motion of bodies in nonNewtonian fluids. A theoretical methodology is developed for the solution of two dimensional Navier-Stokes equations for incompressible nonNewtonian fluid flows past a range of elliptical surfaces. For the investigated flow conditions, methods of analysis involving asymptotic matching techniques of boundary layer equations are not appropriate. Such methods usually assume that

the surface curvature effects and pressure difference across the boundary layer are negligible. Results of the presented research show that these two effects are significant for the flow conditions at hand. The variational formulation of the governing equations of motion and continuity and their discretization by the finite elernent method are developed. Solutions are implemented in a form suitable for efficient numerical computation. The effect of the nonNewtonian fluid on the pressure distribution along the external surface is analyzed. The presented results include velocity profiles and shear stresses along the external surfaces. Author

N86-13672 California Univ., Berkeley.
A THREE-DIMENSIONAL ANALYSIS OF NATURAL CONVECTION IN A TOROIDAL LOOP Ph.D. Thesis
Adrienne Gail Lavine 1984 171 p
Avail: Univ. Microfilms Order No. DA8512897

Flow through a toroidal loop oriented in a vertical plane is studied. This system is a simple example of a class of devices known as thermosyphons or natural circulation loops, which have many applications. When the toroidal loop is heated from below and cooled from above, an unstable density gradient is created in the fluid. Under the influence of gravity, the lighter fluid rises and the heavier fluid fails. Thus, the fluid flows due only to natural convection. Experiments on the toroidal thermosyphon have shown that under steady state flow conditions, the axial velocity and the temperature are nonaxisymmetric, the cross stream velocities are nonzero and regions of streamwise flow reversal exist. The simplified one and two dimensional analyses performed to date have not been able to predict these phenomena. The development of a finite difference computer program for performing a three dimensional analysis of the steady state fluid flow and heat transfer in the toroidal thermosyphon is described. Regions of streamwise flow reversal are predicted in some cases. Simplified analyses which do not take the flow reversals into account are shown to be substantially in error. Hence, the current analysis yields insight into the three dimensional aspects of the flow, which could not be predicted by earlier more simplified analyses. Author

N86-13673 Pittsburgh Univ., Pa.
A COMPUTATIONAL ANALYSIS OF PULSATING FLOW IN RIGID AND DEFORMABLE TUBES Ph.D. Thesis
Timothy Mou-Chang Tsai 1984 159 p
Avail: Univ. Microfilms Order No. DA8512556

A computational analysis was made to study pulsating flow in rigid and deformable, uniform and nonuniform tubes. Two dimensionless forms of the Navier-Stokes equations were used, and a forcing function was introduced in the equations as a dynamic input. Numerical results of pulsating flow in rigid and deformable, uniform and nonuniform vessels were compared. For pulsating flow in deformable tubes, effects of the distensibility of the vessel wall on the flow pattern, pressure field, variation of shear stress, boundary layer development, and energy dissipation were studied. With a same temporal Karman number, radial dilation and contraction of the wall motion were found to have significant effects on the dynamic characteristics of the nonlinear flow process. The influence of nonuniformity of a vessel is studied for rigid and deformation cases. Dissert. Abstr.

N86-13674 State Univ. of New York, Stony Brook.
MODELLING A TRANSPORT EQUATION OF TURBULENT REACTIVE MIXING FLOW Ph.D. Thesis
Tong-Ho Johnsom Hsieh 1984 149 p
Avail: Univ. Microfilms Order No. DA8512704

The evolution of the single-point joint scalar probability density function(pdf) of two reactive scalars in idealized turbulent flows was examined by analytical conditioning and the introduction of appropriate scalar intermittency factors. Closure approximations are proposed for turbulent convection, molecular mixing and entrainment. For non-reactive flows, the closed pdf equation for a two-species turbulent mixing flow is investigated by applying it to the thermal mixing layer of a half-heated grid and to the two-scalar mixing layers behind a two-species grid, where each layer is equivalent to the thermal mixing layer of a half-heated grid. The closures used in the nonreactive case are used to predict the evolution of B chemical species statistics in a reacting flow system for which no experimental data is yet available. The closed scalar pdf equation is also applied to a homogeneous reactive grid flow, for which limited measured data exist; namely, the mean and root mean square concentration of the reactants. The predicted statistics of reactants is moderately close to the measured data. Dissert. Abstr.

N86-13675 Johns Hopkins Univ., Baltimore, Md.
TWO UNSTEADY HEAT TRANSFER EXPERIMENTS. PART 1: IN GRID-GENERATED ISOTROPIC TURBULENCE. PART 2: IN LAMINAR OSCILLATORY FLOW IN STRAIGHT AND CONICAL TUBES Ph.D. Thesis
Ralph Sanders Budwig 1985 116 p
Avail: Univ. Microfilms Order No. DA8510405

A screen of closely spaced, parallel, thin wires was placed downstream of a grid generating nearly isotropic turbulence. The screen was normal to the flow and was heated in one of two modes: (1) periodically in time, to generate a train of transversely uniform streamwise thermal ramps, each with a uniform streamwise gradient; and (2) steadily, with transverse nonuniformity, to generate a uniform transverse thermal ramp. The simple temperature and temperature gradient fluctuation statistical properties in both cases were comparable to those encountered with a steadily heated grid producing a uniform transverse thermal ramp. In both modes of heating the temperature fluctuations decreased initially behind the screen and then increased monotonically. The skewness of the temperature fluctuation derivative in the direction of the main gradient was found to be nonzero despite the absence of mean shear. Experiments on the flow field and the dispersion of heat in laminar oscillatory flow in straight and conical around tubes obtained the fluid point displacements by hydrogen bubble visualization in water and the velocity field by hot-wire anemometry in air. The heat lost through the heating frame and the insulated walls of the tube is estimated from wall temperatures extrapolated from radial profiles in the flow. The terms in the energy equation roughly balance. A plug oscillatory flow model theoretical model generates temperature fluctuations which resemble those in the core of the experimental flow. Dissert. Abstr.

N86-13676*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC SEPARATED FLOW PREDICTIONS BASED ON A MATHEMATICALLY SIMPLE, NONEQUILIBRIUM TURBULENCE CLOSURE MODEL
D. A. Johnson and L. S. King Oct. 1985 14 p refs
(NASA-TM-86826; NAS 1.15:86826) Avail: NTIS HC A02/MF A01 CSCL 20D

A mathematically simple, turbulence closure model designed to treat transonic airfoil flows even with massive separation is described. Numerical solutions of the Reynolds-averaged, Navier-Stokes equations obtained with this closure model are shown to agree well with experiments over a broad range of test conditions. Author

N86-13677*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER AND PRESSURE DROP PERFORMANCE OF A FINNED-TUBE HEAT EXCHANGER PROPOSED FOR USE IN THE NASA LEWIS ALTITUDE WIND TUNNEL
G. James VanFossen Nov. 1985 27 p refs
(NASA-TM-87151; E-2623; NAS 1.15:87151) Avail: NTIS HC A03/MF A01 CSCL 20D

A segment of the heat exchanger proposed for use in the NASA Lewis Altitude Wind Tunnel (AWT) facility has been tested under dry and icing conditions. The heat exchanger has the largest pressure drop of any component in the AWT loop. It is therefore critical that its performance be known at all conditions before the final design of the AWT is complete. The heat exchanger segment is tested in the NASA Lewis Icing Research Tunnel (IRT) in order to provide an icing cloud environment similar to what will be encountered in the AWT. Dry heat transfer and pressure drop

data are obtained and compared to correlations available in the literature. The effects of icing sprays on heat transfer and pressure drop are also investigated. Author

N86-13678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETERMINATION OF CONVECTIVE DIFFUSION HEAT/MASS TRANSFER RATES TO BURNER RIG TEST TARGETS COMPARABLE IN SIZE TO CROSS-STREAM JET DIAMETER
Sueleyman A. Goekoglu (Case Western Reserve Univ.) and Gilbert J. Santoro [1985] 15 p refs Proposed for presentation at the 31st International Gas Turbine Conference, Dusseldorf, 8-12 Jun. 1986; sponsored by ASME
(NASA-TM-87176; E-2722; NAS 1.15:87176) Avail: NTIS HC A02/MF A01 CSCL 20D

Two sets of experiments have been performed to be able to predict the convective diffusion heat/mass transfer rates to a cylindrical target whose height and diameter are comparable to, but less than, the diameter of the circular cross-stream jet, thereby simulating the same geometric configuration as a typical burner rig test specimen located in the cross-stream of the combustor exit nozzle. The first set exploits the naphthalene sublimation technique to determine the heat/mass transfer coefficient under isothermal conditions for various flow rates (Reynolds numbers). The second set, conducted at various combustion temperatures and Reynolds numbers, utilized the temperature variation along the surface of the above-mentioned target under steady-state conditions to estimate the effect of cooling (dilution) due to the entrainment of stagnant room temperature air. The experimental information obtained is used to predict high temperature, high velocity corrosive salt vapor deposition rates in burner rigs on collectors that are geometrically the same. The agreement with preliminary data obtained from Na2SO4 vapor deposition experiments is found to be excellent. Author

N86-13679*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION OF NONCONFORMAL CONTACTS Ph.D. Thesis
Yeau-Ren Jeng Sep. 1985 154 p refs
(Contract NCC3-30)
(NASA-TM-87120; E-2728; NAS 1.15:87120) Avail: NTIS HC A08/MF A01 CSCL 20D

Minimum film thickness results for piezoviscous-rigid regime of lubrication are developed for a compressible Newtonian fluid with Roelands viscosity. The results provide a basis for the analysis and design of a wide range of machine elements operating in the piezoviscous-rigid regime of lubrication. A new numerical method of calculating elastic deformation in contact stresses is developed using a biquadratic polynomial to approximate the pressure distribution on the whole domain analyzed. The deformation of every node is expressed as a linear combination of the nodal pressures whose coefficients can be combined into an influence coefficient matrix. This approach has the advantages of improved numerical accuracy, less computing time and smaller storage size required for influence matrix. The ideal elastohydrodynamic lubrication is extended to real bearing systems in order to gain an understanding of failure mechanisms in machine elements. The improved elastic deformation calculation is successfully incorporated into the EHL numerical scheme. Using this revised numerical technique and the flow factor model developed by Patir and Cheng (1978) the surface roughness effects on the elastohydrodynamic lubrication of point contact is considered. Conditions typical of an EHL contact in the piezoviscous-elastic regime entrained in pure rolling are investigated. Results are compared with the smooth surface solutions. Experiments are conducted to study the transient EHL effects in instrument ball bearings. Author

N86-13680# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
WAVE FORCE-PHASE METHOD FOR VERTICAL CYLINDERS Final Report, May 1984 - Feb. 1985
J. H. Nath May 1985 76 p
(Contract N62474-82-C-0295)
(AD-A157709; NCEL-CR-85.008) Avail: NTIS HC A05/MF A01 CSCL 20/4

The maximum force and its phase is determined for laboratory wave forces on smooth vertical cylinders. The maximum force coefficient and the normalized phase angle of the force with respect to the wave particle velocity, can be related to the force transfer coefficients, C subscript d and c subscript m, for the Morison equation. This method enables the data to be plotted in a way that immediately shows the drag or inertia dependency for the wave/cylinder conditions. In addition, the C subscript d and C subscript m so derived are more likely to properly predict the maximum value of the force, although they may also increase the rms error between the measured force and the predicted force in the time domain. GRA

N86-13681# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
HIGH REYNOLDS NUMBER WAVE FORCE INVESTIGATION IN A WAVE FLUME Final Report, Sep. 1982 - Feb. 1985
R. T. Hudspeth and J. H. Nath Mar. 1985 225 p
(Contract N62474-82-C-08295)
(AD-A157722; NCEL-CR-85.004) Avail: NTIS HC A10/MF A01 CSCL 20/4

A 12.75 inch diameter vertical cylinder was subjected to large laboratory waves with Keulegan-Carpenter number up to 17 at the local force transducer (20 at the still water surface) and Reynolds number up to 270,000 (320,000 at the still water surface). Local force, local pressures, total force, and the elements for determining the overturning moments were measured. The purpose was to produce a high quality data set in the wave regime where both the velocity and the acceleration-dependent components of the wave forces are important. It was found that the forces were more acceleration-dependent than originally anticipated. The local forces were predicted quite well with the two-term Morison equation using the kinematics from the measurements, the linear, and the stream function wave theories. The best predictions used the measured kinematics. GRA

N86-13682# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
A FULLY VISCOUS TWO-DIMENSIONAL UNSTEADY FLOW ANALYSIS APPLIED TO DETONATION TRANSITION IN POROUS EXPLOSIVES Final Technical Report, May 1982 - Mar. 1985
H. Krier, M. R. Dahm, and L. S. Samuelson Jun. 1985 117 p
(Contract F08635-82-K-0321)
(AD-A157794; AD-E801156; UILU-ENG-84-4009;
AFATL-TR-85-12) Avail: NTIS HC A06/MF A01 CSCL 19/4

This report describes significant new progress towards solving the two-dimensional fully viscous unsteady flow in a reactive solid/gas mixture. The results demonstrate that it may be possible to predict whether a warhead with case failure (and filled with fragmented high explosive) will produce a low order detonation which is weaker than the one required to damage a structure. The loss of mass, momentum, and energy through a warhead case opening is a multi-dimensional problem even though the reaction front may progress axially through the damaged explosive. Mass is ejected in a basically radial direction and necessitates a multi-dimensional problem formulation in order to model the deflagration to detonation transition event accurately enough to make meaningful predictions. The appropriate equations of state and continuity equations are formulated and are solved by a finite differencing scheme. Run-up length to detonation in the fragmented explosive bed from a case opening through which mass is ejected should be married with a model of probabilistic case failure on impact to predict warhead lethality. GRA

N86-13683# Coastal Engineering Research Center, Vicksburg, Miss.
ITERATIVE AND PADE SOLUTIONS FOR THE WATER-WAVE DISPERSION RELATION Final Report
H. S. Chen and E. F. Thompson Apr. 1985 24 p

(AD-A157796; CERC-85-4) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report gives the iterative and Pade solutions of the propagating and evanescent wave modes of the dispersion relation for the linear water-wave theory. Their corresponding FORTRAN subroutines are also provided. The Pade solution is generally more efficient than the iterative one in most engineering applications. GRA

N86-13684# United Research Corp., Santa Monica, Calif.
WAVES WHICH TRAVEL UPSTREAM IN BOUNDARY LAYERS Final Report, Mar. 1982 - Aug. 1984
H. L. Rogler Jul. 1985 57 p
(Contract F40600-79-C-0002)
(AD-A157949; AEDC-TR-83-7) Avail: NTIS HC A04/MF A01 CSCL 20/4

Upstream propagation and diffusion of vorticity in a boundary layer is described by a numerical solution of the Orr-Sommerfeld equation. This traveling wave grows very rapidly in the downstream direction. The growth rate is approximately exp(+ R (sub delta)x) where R sub delta is the Reynolds number based on the characteristic boundary layer thickness, and x is the streamwise coordinate nondimensionalized against delta. Far from the boundary layer, the solution oscillates neutrally in the Y-direction. Analyses reveal high frequency wave which oscillates and decays in the y-direction approximately as exp(-i R(sub delta) y - omega Y) where omega is the frequency. This high frequency wave can survive into the freestream. Numerical solutions of the Orr-Sommerfeld equation with a Blasius layer are obtained by a series expansion of Chebyshev polynomials. Since the y-wavenumber of the oscillations increases with increasing Reynolds number, the calculations have been restricted to low Reynolds numbers. In the boundary-value problem, this solution appears as a branch line in Laplace space. It is one of the possible solutions in a mathematically complete description of the spatial evolution of fluctuations. This traveling wave represents one of the upstream influences of a boundary in a calculational domain. Another mechanism of upstream influence is the growing standing wave. GRA

N86-13685# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
BOUNDARY-VALUE PROBLEM FOR TWO-DIMENSIONAL FLUCTUATIONS IN BOUNDARY LAYERS Final Report, Mar. 1979 - May 1985
S. Tsuge and H. L. Rogler Jul. 1985 51 p Prepared in cooperation with United Research Corp., Santa Monica, Ca
(AD-A157952; AEDC-TR-83-9) Avail: NTIS HC A04/MF A01 CSCL 20/4

The streamwise evolution of disturbances in a boundary layer is described as an asymptotic solution of the forced Orr-Sommerfeld equation. The velocity fluctuations and their derivations are specified along the y-axis. With these boundary conditions, the effects are included of vortical and irrotational free stream disturbances, fluctuations originating from leading edges, and discrete eigenmodes. A Fourier transform in time and a Laplace transform in the streamwise direction are used. Complementary and particular integrals are found and the inverse transforms are taken. Five families of 2-D fluctuations can exist in a parallel-flow, incompressible boundary layer. Three families have exponentially growing fluctuations, one of which is the Tollmien stability wave. Another is an exponentially-growth standing wave that oscillates in time and does not travel. This fluctuation appears as a mathematical pole in transform space, like the stability waves, but does not vanish far away from the boundary layer. A third growing fluctuation appears in Laplace space as a branch line. This continuous spectrum diffuses and travels upstream. The last two of these three growing fluctuations are excluded in our quarter-plane problem that extends forever downstream. Besides the Tollmien wave that can grow or decay in the streamwise direction, the other discrete modes appearing as mathematical poles are damped. Two other decaying fluctuations appear. GRA

N86-13686# Virginia Research Associates, Blacksburg.
NEW FLOW VISUALIZATION TECHNIQUE FOR WATER TUNNEL TESTING OF COMBUSTORS Final Report, Sep. 1984 - Apr. 1985
J. A. Schetz, F. Sebba, and R. L. Simpson Apr. 1985 52 p
(Contract F33615-84-C-2468)
(AD-A158015; AFWAL-TR-85-2042) Avail: NTIS HC A04/MF A01 CSCL 20/4

A new technique for water tunnel flow visualization is based upon the use of a newly developed type of material--neutral-density, bi-liquid foams or polyaphrons. These materials are small, spherical globules of one liquid encapsulated in a thin film of another liquid. It is now possible to make bi-liquid foams when the units are of micron or submircon size, and may be spherical or polyhedral depending upon the relative concentration of oil to water. They are easy to see and photograph in water and they can also be dyed to a variety of intense colors. In this two part study, polyaphrons were used for flow visualization in water tunnel tests of combustors. First, various formulations of the polyaphrons were made to optimize aphron size and density for water tunnel testing. Second, the best polyaphrons were used for flow visualization of real, prototype combustor model. Tests were conducted at 22.5 gpm. This corresponds to Re sub D=23,900, when D is the swirler diameter. Tests showed that polyaphron material proved easy to handle when injected through small tubes and the amount and ratio of injection was easy to control. No clogging of any kind was ever encountered. The pure material broke-up into clumps upon injection. A 50/50 mixture of water polyaphron eliminated clumping. Injection of polyaphrons was also directly compared with the more usual dye injection. Polyaphrons are ideal seeding material for Laser Doppler Velocimetry in water tunnels. GRA

N86-13687# Naval Research Lab., Washington, D. C.
NUMERICAL SIMULATIONS OF ASYMMETRIC MIXING IN PLANAR SHEAR FLOWS Interim Report
F. F. Grinstein, E. S. Oran, and J. P. Boris 23 Aug. 1985 50 p Original contains color illustrations
(AD-A158024; NRL-MR-5621) Avail: NTIS HC A03/MF A01 CSCL 20/4

Numerical simulations were performed of the evolution of the Kelvin-Helmholtz instability in planar, free shear layers, resulting from coflow past a splitter plate. The calculations solved the time-dependent compressible conservation equations for which new algorithms were developed and tested for inflow and outflow boundary conditions. The transition from laminar flow was triggered by transverse pressure gradients and subsequent vorticity fluctuations at the shear layer, near the tip of the splitter plate. The calculations were performed for a range of free-stream velocity ratios and sizes of the chamber enclosing the system. The simulations showed that the resulting mixing layers have more of the faster fluid than the slower fluid entrained in the roll-ups. This effect is in general agreement with the results of recent splitter-plate experiments of Koochesfahani, Dimotakis and Broadwell (1983). The calculated mixing asymmetry is more apparent when the velocity ratio of the two streams is larger, and does not depend significantly on the separation between the walls of the chamber. GRA

N86-13688# Cambridge Acoustical Associates, Inc., Mass.
SENSITIVITY TO MEAN FLOW PARAMETERS OF THE LOW WAVENUMBER CONTENT OF THE WALL PRESSURE UNDER A TURBULENT BOUNDARY LAYER Final Report, 1 Dec. 1983 - 31 May 1985
J. E. Cole, III 26 Apr. 1985 45 p
(Contract N00014-84-C-0141)
(AD-A158037; CAA-U-1205-333; DTNSRDC-2280) Avail: NTIS HC A03/MF A01 CSCL 20/4

The objective of this study is to examine the sensitivity of the low wavenumber portion of the wall pressure field under a turbulent boundary layer to both flow and wall conditions. The analytical procedure makes use of a method for calculating the broadband correlation function of the wall pressure field in which the specific flow characteristics enter through profiles of the mean velocity

shear and turbulence intensity across the boundary layer. The basic assumption used to extend the results of this procedure to narrowband frequency characteristics is that there is a range of large spatial separations in which Strouhal scaling is not important. Several specific boundary layers are considered including flows on smooth and rough walls and in zero, favorable, and adverse pressure gradients. Results are presented for the point pressure, the spatial correlation function, and the low wavenumber spectral level. GRA

N86-13689# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
PORE PRESSURE RESPONSE TO PROBE INSERTION AND THERMAL GRADIENT: ISIMU-2. (IN SITU HEAT TRANSFER EXPERIMENT) Final Report
M. Riggins, P. J. Valent, H. Li, J. T. Burns, and C. E. Hickox Jul. 1985 81 p
(AD-A158592; NORDA-TN-259) Avail: NTIS HC A05/MF A01 CSCL 08/10

The described experiment and the evaluation of its results were designed to assess the significance of the sediment cracking occurring during piezometer and heater probe insertion, and the influence of the cracking on the subsequent excess pore pressure and thermal fields to be measured in the In Situ Heat Transfer Experiment (ISHTE). The ISHTE is part of the Subseabed Disposal Program (SDP). Observed sediment radial cracking was estimated to penetrate to about one-half penetrator diameter. Measured penetrator insertion pore pressures and excess pore pressure dissipation indicate that sediment cracking has no identifiable influence at the penetration depth of the sensors. Proper prediction of the dissipation of insertion pore pressures was found to require incorporation of a smear factor, accounting for sediment remolding at the piezometer wall. An analytical model to concurrently describe the rise in excess pore pressure due to sediment heating and the pore pressure dissipation radially away from the heat source is described and the results of its application to the experiment data evaluated. GRA

N86-13690# Florida Univ., Gainesville.
FAR-FIELD BOUNDARY CONDITIONS IN NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS Final Report, 24 Oct. 1984 - 1 Apr. 1985
P. J. McKenna 10 May 1985 61 p
(Grant AF-AFOSR-0330-83)
(AD-A158776; AFOSR-85-0625TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

The purpose of this project was to investigate the artificial boundary conditions which must be imposed at the boundary of a numerical grid. Numerical experiments were performed which evaluated various boundary conditions of this type. Of particular interest was the question of whether linearization around the flow at infinity provides an adequate choice of boundary condition for the fully nonlinear equations. Inflow-outflow conditions as well as several choices of periodic boundary conditions were considered. The inflow-outflow conditions worked reasonably well for two dimensional problems. For the periodic conditions, results were mixed. Concerns about over specification when using pure periodic conditions proved to be groundless. However, the method failed when attempting to use periodicity in the two sideways traveling periodic waves. GRA

N86-13691# California Univ., Berkeley. Mathematical Sciences Research Inst.
TURBULENCE AND DYNAMICAL SYSTEMS Final Report, 1 Jul. 1983 - 31 Dec. 1984
A. Chorin, J. Feldman, and C. C. Moore 31 Dec. 1984 21 p
(Grant AF-AFOSR-0265-83)
(AD-A159026; AFOSR-85-0646TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The emphasis in this program was on the bringing together, in connection with the overall effort on dynamical systems, researchers from physics, mathematics, engineering; working in the various aspects of liquid helium theory, crystal growth, etc. This report summarizes the results of a workshop and contains 8 abstracts on related topics. GRA

N86-13692# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
USER'S MANUAL FOR THE GENERALIZED COMPUTER PROGRAM SYSTEM. OPEN-CHANNEL FLOW AND SEDIMENTATION, TABS-2. MAIN TEXT Final Report
W. A. Thomas and W. H. McAnally, Jr. Jul. 1985 39 p
(AD-A159249; WES/TR/HL-85-1) Avail: NTIS HC A03/MF A01 CSCL 08/8

TABS-2 is a generalized numerical modeling system for open-channel flows, sedimentation, and constituent transport. It consists of more than 40 computer programs to perform modeling and related tasks. The major modeling components--RMA-2V, STUDH, and RMA-4--calculate two-dimensional, depth-averaged flows, sedimentation, and dispersive transport, respectively. The other programs in the system perform digitizing, mesh generation, data management, graphical display, output analysis, and model interfacing tasks. Utilities include file management and automatic generation of computer job control instructions. TABS-2 has been applied to a variety of waterways, including rivers, estuaries, bays, and marshes. It is designed for use by engineers and scientists who may not have a rigorous computer background. Use of the various components is described in Appendices A-O. The bound version of the report does not include the appendices. A looseleaf form with Appendices A-O is distributed to system users.
Author (GRA)

N86-13693# Los Alamos National Lab., N. Mex.
TURBULENCE IN TWO-FIELD INCOMPRESSIBLE FLOW
D. Besnard and F. H. Harlow May 1985 113 p
(Contract W-7405-eng-36)
(DE85-015361; LA-10187-MS) Avail: NTIS HC A06/MF A01

We derive in this report a model for two-field turbulence. This model gives most of the required features, such as mass diffusion, damping of the turbulence in the second fluid due to the presence of the first one, and decay of the turbulent kinetic energy. We also derive from it a k-epsilon model, which could be used for many applications. DOE

N86-13694# California Univ., Berkeley. Lawrence Berkeley Lab.
INVESTIGATION OF THE VERTICAL-FLOW AQUIFER THERMAL ENERGY STORAGE CONCEPT AND NUMERICAL SIMULATION OF THE DORIGNY FIELD EXPERIMENT
C. Doughty and C. F. Tsang May 1985 10 p Presented at the ENERSTOCK ' 85 - Intern. Conf. on Energy Storage for Bldg. Heating and Cooling, Toronto, 22 Sep. 1985
(Contract DE-AC03-76SF-00098)
(DE85-014524; LBL-19645; CONF-850905-3) Avail: NTIS HC A02/MF A01

A mathematical modeling study of the vertical-flow aquifer thermal energy storage concept is made. A history match calculation of the Dorigny field experiment, part of the SPEOS project, is carried out using two simplified models. Then the main heat-loss mechanisms are isolated to study their relative importance. Finally, variations on the Dorigny experimental configuration are studied to examine the behavior of the vertical-flow storage system in general. DOE

N86-13695# Los Alamos National Lab., N. Mex.
EXPERIMENTS WITH NON-DARCY FLOW IN JOINTS WITH LARGE SCALE ROUGHNESS
D. K. Cornwell and H. D. Murphy 1985 11 p refs Presented at the Intern. Symp. on Fundamentals of Rock Joints, Bjorkliden, Sweden, 15 Sep. 1985
(Contract W-7405-eng-36)
(DE85-015714; LA-UR-85-2454; CONF-8509129-2) Avail: NTIS HC A02/MF A01

Joints are normally in contact at roughness asperities. Consequently, the relative roughness, the ratio of the asperity protrusion to the mean flow aperture, is approximately one, which is orders of magnitude greater than that encountered in more usual situations

such as pipe and channel flows. In these experiments the joint roughness is idealized with sawtooth corrugations. It is found that Darcy's Law becomes invalid for Reynolds numbers greater than about 100. Hence, for most of these studies the flow is non-Darcian, and so the usual convention of representing pressure losses in terms of an apparent friction factor is adopted. When the roughness peaks are aligned, resulting in maximum flow disturbance, the friction factor increases when the relative roughness is increased, simulating the closure of a joint due to normal-direction loading. However, when the roughness peaks are 180 deg out of phase, so that peaks are opposite valleys, the friction factor initially increases with greater relative roughness, but then decreases.
DOE

N86-13696# Sandia National Labs., Albuquerque, N. Mex.
CRITICAL CHARGE FOR THE DIRECT INITIATION OF DETONATION IN GASEOUS FUEL-AIR MIXTURES
W. B. Benedick, C. M. Guirao, R. Knystautas, and J. H. Lee 4 Aug. 1985 30 p refs Presented at the 10th Intern. Colloq. on Dyn. of Explosions and Reactive Systems, Berkeley, Calif., 4 Aug. 1985 Prepared in cooperation with McGill Univ., Montreal
(Contract DE-AC04-76DP-00789)
(DE85-016130; SAND-85-1716C; CONF-850830-6) Avail: NTIS HC A03/MF A01

The results of measurements of the critical initiation energy for hydrogen air mixtures performed in a large scale facility are described. These results for hydrogen air mixtures, in conjunction with earlier measurements are used to assess the accuracy of existing phenomenological models. A comprehensive review of the theoretical models used to predict the critical initiation energy of unconfined detonation in reactive mixtures is presented. Three initiation energy models, the surface energy model of Lee, the cell energy model of Vasiliev and Grigoriev, and the detonation kernel model of Ramanurthi and Lee are found to correlate well with the experimental critical charge data for hydrogen air, ethane air, propane air and butane air mixtures. For ethylene air mixtures, none of the existing models predict the whole range of initiation energy data. From examination of the hydrogen air data, the calculated explosion length R0, for critical conditions is of the order of R0 approx. =1.5 d sub c, where d sub c is the critical tube diameter. This is compatible with the reinitiation distance of approx. 2 d sub c for the critical tube situation observed by Ungut, et al. The correlation R0 approx. =1.5 d sub c provides a better estimate of the critical initiation energy than can be obtained from direct measurements which are influenced by the characteristics of the initiation source. DOE

N86-13697# Lawrence Livermore National Lab., Calif.
GRANULAR FLOW: ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT (AR AND TD) CONTRACT REVIEW
O. R. Walton 19 Jul. 1985 13 p Presented at the AR and TD Direct Utilization Contractors' Meeting, Morgantown, W. Va., 13 Aug. 1985
(Contract W-7405-eng-48)
(DE85-017267; UCRL-92992; CONF-850878-5) Avail: NTIS HC A02/MF A01

The objective of the granular flow project is to develop an understanding for and an ability to predict the flow behavior of granular solids. New reseach tools are developed as part of this task in the form of new two and three-dimensional discrete particle computer models that can provide detailed information on both the microscopic and macroscopic deformations occurring in flowing granular solids. These computer models calculate the motion of each individual particle in an assembly of many inelastic, frictional particles responding to applied loads, boundaries and/or gravity. New interparticulate force models were developed that realistically simulate collision behavior between spheres and disks under rapid shearing conditions. A new two-dimensional steady-state shearing model, using periodic boundaries on all sides of a primary calculational cell was used to determine the rheologic properties of assemblies of disks and the dependence of these rheologic properties on the shear rate, and on the inelasticity and surface friction properties of the disks. Real boundaries and gravity were added to this two-dimensional model. Three-dimensional steady-state shearing and real boundary models with spherical particles are under development. When these are completed direct comparisons can be made between various existing laboratory studies and the three-dimensional computer simulations. DOE

N86-13698# Argonne National Lab., Ill.
DEVELOPMENT OF CONTACT/IMPACT CAPABILITY FOR THE THREE-DIMENSIONAL FLUID-STRUCTURE INTERACTION CODE: NEPTUNE
R. F. Kulak and C. Fiala 1985 14 p refs Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-010264; CONF-850809-52) Avail: NTIS HC A02/MF A01

A method, which uses a family of adaptive contact elements, is developed for treating the mechanics of contact/impact between two deformable bodies. The contact element's nodal connectivity is allowed to change during the computations in order to accommodate finite sliding. The methodology has been implemented into the NEPTUNE finite element program. Results are presented for an illustrative problem. DOE

N86-13699# Massachusetts Inst. of Tech., Cambridge.
STUDY OF DEPOSITION CONTROL USING TRANSPIRATION Technical Progress Report
J. F. Louis and H. Kozlu May 1985 5 p
(Contract DE-AC21-83MC-20334)
(DE85-012799; DOE/MC-20334/T19) Avail: NTIS HC A02/MF A01

Modeling of particle transport across the transpired turbulent boundary layer by introducing the Schmidt number as a function of the normal distance to the wall is performed. A major problem is to determine how the Schmidt number varies within the boundary layer. Schmidt number is affected by the flow structure as well as the mechanics of aerosols. The validated model for transpired turbulent boundary layer has shown that eddy sizes are constant across the boundary layer. Therefore, it is expected that the Schmidt number should be constant for every particle size in the boundary layer operating with strong blowing except for the region very close to the wall. Based on the above analysis, it is expected that these structure differences in the flow will cause a drastic change (i.e., like a step function) of Schmidt number very near the wall. The region close to the wall has to be carefully characterized. For large injection rates, the flow close to the wall is dominated by the injected flow emerging from the porous wall. According to the manufacturer, the porous wall is made of very small beads with a diameter of 6 (MU). Therefore the emerging flow has nonuniformity characterized by a maximum length of 6 (MU) which is appreciably smaller than the particle diameter, i.e., 16 (MU). In the region very close to the wall, the Schmidt number associated with the particles is large. DOE

N86-13700# Sandia National Labs., Albuquerque, N. Mex.
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER BEHAVIOR OF AQUEOUS FOAMS IN THERMAL ENTRY REGION OF PIPE FLOW
B. F. Blackwell and K. A. Butler 1985 9 p Presented at the Natl. Heat Transfer Conf., Denver, 4 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE85-012836; SAND-85-1089C; CONF-850810-20) Avail: NTIS HC A02/MF A01

An experimental facility for studying the heat transfer behavior of aqueous foams flowing in the thermal entry region of a pipe has been designed and fabricated. Temperature profiles have been measured at the exit of a 3 m (9.83 ft) long x 2.58 cm (1.015 in.) diameter tube using a chromel/alumel thermocouple probe and a micrometer adjusted traversing mechanism. Two foam consistencies were studied; nominal liquid volume fractions of 0.10 and 0.15. Analytical predictions of temperature profile, boundary layer thickness, and local Nusselt No. are compared with experimental data. It appears that the thermal conductivity variation with liquid

volume fraction is more complex than the linear model proposed by other foam experimenters. DOE

N86-13701# New York Univ., New York. Mathematics and Computing Lab.
SHOCK WAVES, INCREASE OF ENTROPY AND LOSS OF INFORMATION
P. D. Lax Oct. 1984 46 p
(Contract DE-AC02-76ER-03077)
(DE85-013645; DOE/ER-03077/240) Avail: NTIS HC A03/MF A01

For the simplified model of a single conservation law, the concepts of genuine nonlinearity, breakdown of classical solutions, solutions in the distribution sense and their nonuniqueness, the viscosity method, finite difference methods, and the shock condition are discussed. For the scalar model, the compactness of solutions constructed by the viscosity and difference methods are also discussed, and the entropy inequality for such solutions is derived. Glimm's estimate for the total variation of solutions of scalar equations that satisfy the shock condition is also derived, and it is shown that a discontinuous solution that satisfies the shock condition also satisfies the entropy condition. Scattered remarks are given about the equations of compressible flow: the increase of entropy, some consequences of Carnot's theorem, and the equipartition of energy in the wake of strong shocks. DOE

N86-13702*# Los Alamos National Lab., N. Mex.
HYBRID SIMULATION CODES WITH APPLICATION TO SHOCKS AND UPSTREAM WAVES
D. Winske 3 Feb. 1985 15 p refs Presented at the 2nd Intern. School of Space Simulation, Kapaa, Hawaii, 3-15 Feb. 1985 Sponsored by NASA
(Contract W-7405-eng-36)
(NASA-CR-176365; NAS 1.26:176365; DE85-007702; LA-UR-85-452; CONF-850266-4) Avail: NTIS HC A02/MF A01 CSCL 20D

Hybrid codes in which part of the plasma is represented as particles and the rest as a fluid are discussed. In the past few years such codes with particle ions and massless, fluid electrons have been applied to space plasmas, especially to collisionless shocks. All of these simulation codes are one dimensional and similar in structure, except for how the field equations are solved. The various approaches that are used (resistive Ohm's law, predictor corrector, Hamiltonian) are described and results from the various codes with examples taken from collisionless shocks and low frequency wave phenomena upstream of shock compared. Author

N86-13703# Lawrence Livermore National Lab., Calif.
CONTRIBUTIONS TO VON KARMAN INSTITUTE LECTURE SERIES ON COMPUTATIONAL FLUID DYNAMICS: ADVECTION-DIFFUSION AND NAVIER-STOKES EQUATIONS
P. M. Gresho Mar. 1985 174 p Presented at Von Karman Inst. Lecture Ser. on Computational Fluid Dyn., Brussels, 25 Mar. 1985
(Contract W-7405-eng-48)
(DE85-010942; UCRL-92275; CONF-8503148-1) Avail: NTIS HC A08/MF A01

An appropriate starting point for the numerical simulation of fluid flow is the study of the simpler, yet important equation of advection-diffusion (AD), in which the velocity field is presumed to be known. Many fluid flow simulations are primarily concerned with the transport and diffusion of scalar quantitites such as heat (temperature) or concentration (e.g., air pollution). Unfortunately, even in these cases, the more difficult to obtain velocity field must (usually) be computed first. We assume that the velocity is known; later we return to the problem of computing the velocity field itself. Two papers are also included on the finite method for solving the time-dependent, incompressible Navier-Stokes equations. DOE

N86-13704# Argonne National Lab., Ill.
FLUID FORCES ON TWO CIRCULAR CYLINDERS IN CROSSFLOW
J. A. Jendrzejczyk and S. S. Chen Jun. 1985 60 p
(Contract W-31-109-eng-38)
(DE85-014294; ANL-85-35) Avail: NTIS HC A04/MF A01

Fluid excitation forces are measured in a water loop for two circular cylinders arranged in tandem and normal to flow. The Strouhal number and fluctuating drag and lift coefficients for both cylinders are presented for various spacings and incoming flow conditions. Results show the effects of Reynolds number, pitch ratio, and upstream turbulence on the fluid excitation forces. DOE

N86-13705# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF EARTH OBSERVATION BY FREQUENCY SCANNING. VOLUME 1: EXECUTIVE SUMMARY
D. Miller, H. Schuessler, P. Stuerzenhofaecker, M. Westphal, J. E. Charlton (British Aerospace Dynamics Group, Bristol, UK), T. T. Joyce (British Aerospace Dynamics Group, Bristol, UK), A. Thomson, D. C. Hawkins, and P. R. Foster Paris ESA Nov. 1984 18 p 2 Vol.
(Contract ESTEC-5717/83/NL-MS)
(ESA-CR(P)-2028-Vol-1) Avail: NTIS HC A02/MF A01

Microwave remote sensing from space necessitates instruments to operate under severe constraints. One method of reducing the demands of power and mechanical complexity is to improve the antenna directivity and steer the beam electrically. Frequency scanning provides a simple and elegant means of using frequency to control the antenna beam direction. It enables the beam to be steered rapidly in space without moving large mechanical masses and more efficiently utilises the available r.f. power directing it more precisely to the region of interest. In comparison with active inertiales scanning techniques, frequency scanning is simple and reliable and hence particularly attractive for spaceborne sensors. This study is aimed at exploring the potential of frequency scanning as a technique for reducing the demand of microwave remote sensing instruments on the resources of the spacecraft. The applications for investigation are Scatterometry and imaging Radiometry. Author (ESA)

N86-13706# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF EARTH OBSERVATION BY FREQUENCY SCANNING. VOLUME 2 Final Report
D. Miller, H. Schuessler, P. Stuerzenhofaecker, M. Westphal, J. E. Charlton (British Aerospace Dynamics Group, Bristol, UK), T. T. Joyce (British Aerospace Dymanics Group, Bristol, UK), A. Thomson, D. C. Hawkins, and P. R. Foster Paris ESA Nov. 1984 381 p refs 2 Vol.
(Contract ESTEC-5717/83/NL-MS)
(ESA-CR(P)-2028-Vol-2) Avail: NTIS HC A17/MF A01

The potential of frequency scanning for reducing the demand of microwave remote sensing instruments on the resources of the spacecraft in scatterometry and imaging radiometry was investigated. Applied to a single channel passive microwave radiometer, frequency scanning offers saving in mass and avoids a single point failure mode by eliminating the scanning mechanism. However, the wide swath requirement precludes higher microwave frequencies due to the high wrap-up factors that result in high losses. A multifrequency capability can only be achieved by using an antenna structure dedicated to each channel. A frequency sensitive pushbroom system with the potential to offer a better radiometric sensitivity may be superior for applications which require a single frequency and long integration time. Author (ESA)

N86-13707# Universite de Valenciennes et du Hainaut-Cambresis (France).
BEHAVIOR OF SLENDER CONES AT LARGE INCIDENCES Final Report [COMPORTEMENT DES CONES ELANCES A GRANDE INCIDENCE]
A. Morteveille and C. Tournier Jan. 1985 86 p refs In FRENCH
(Contract DRET-83-1095)
Avail: NTIS HC A05/MF A01

Wall velocity gradients in magnitude and direction around

slender cones were studied for incidences from 30 to 90 deg. A polarographic method is used to measure the wall instantaneous values without perturbation of the fluid flow. The nonsteady characteristics of each component of the gradient are given. A hydraulic channel with a redox polarographic solution at 20 C was used. The results show an increase of flow instability with incidence, with a maximum at 60 deg for the ideal cone and 75 deg for the blunted cone. Author (ESA)

N86-13566# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemical Engineering and Environment Engineering.
EFFECT OF INTERFACIAL PHENOMENA ON CONTACT LINE HEAT TRANSFER Abstract Only
Peter C. Wayner, Jr. *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13577# Aerometrics, Inc., Mountain View, Calif.
SPRAY CHARACTERIZATION USING PHASE ANGLE DETECTION Abstract Only
William D. Bachaio *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13580# Spectron Development Labs., Inc., Costa Mesa, Calif.
SPRAY CHARACTERIZATION WITH A NONINTRUSIVE OPTICAL SINGLE PARTICLE COUNTER Abstract Only
Cecil F. Hess *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13583# Texas Univ. at Dallas, Richardson.
REAL-TIME, TWO-DIMENSIONAL FUEL SPRAY VISUALIZATION Abstract Only
Lynn A. Melton and James F. Verdieck (United Technologies Research Center, East Hartford, Conn.) *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13768# Joint Publications Research Service, Arlington, Va.
FORMATION OF STRUCTURE OF MIXED REGION UNDER INFLUENCE OF SHEAR FLOW IN STRATIFIED FLUID Abstract Only
L. A. Dykhno *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 9 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 528-536 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14094*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
AN ANALYSIS OF CRYOTRAP HEAT EXCHANGER PERFORMANCE TEST DATA (400 AREA) AND RECOMMENDATIONS FOR A SYSTEM TO HANDLE APOLLO RCS ENGINES Final Report
Allen Rakow *In its* The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Report Sep. 1983 15 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20D

N86-14096*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
SPARGER SYSTEM FOR MMH-HELIUM VENTS Final Report
Allen Rakow *In its* The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 17 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20D

N86-14158# Joint Publications Research Service, Arlington, Va.
ROSSBY AUTOSOLITON Abstract Only
S. V. Antipov, M. V. Nezlin, and A. S. Trubnikov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 68 Transl. into ENGLISH from Pisma v Zh. Eksperim. i Teor. Fiz. (Moscow), v. 41, no. 1, Jan. 1985 p 25-28 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-13708*# Aerojet Techsystems Co., Sacramento, Calif.
ROCKET ENGINE HOT-SPOT DETECTOR Final Report
F. N. Collamore Apr. 1985 185 p refs
(Contract NAS9-16282)
(NASA-CR-171902; NAS 1.26:171902;
Rept-16282-T-1646-MA-129T-002F) Avail: NTIS
HC A09/MF A01 CSCL 14B

On high performance devices such as rocket engines it is desirable to know if local hot spots or areas of reduced cooling margin exist. The objective of this program is to design, fabricate and test an electronic hot spot detector capable of sensing local hot spot on the exterior circumference of a regeneratively cooled combustion chamber in order to avoid hardware damage. The electronic hot spot sensor consists of an array of 120 thermocouple elements which are bonded in a flexible belt of polyimide film. The design temperature range is from +30 F to +400 F continuously with an intermittent temperature of 500 F maximum. The thermocouple belt consists of 120 equally spaced copper-Constantan thermocouple junctions which is wrapped around the OMS liquid rocket engine combustion chamber, to monitor temperatures of individual cooling channels. Each thermocouple is located over a cooling channel near the injector end of the combustion chamber. The thermocouple array sensor is held in place by a spring loaded clamp band. Analyses show that in the event of a blocked cooling channel the surface temperature of the chamber over the blocked channel will rise from a normal operating temperature of approx. 300 F to approx. 600 F. The hot spot detector will respond quickly to this change with a response time constant less than 0.05 seconds. The hot spot sensor assembly is fabricated with a laminated construction of layers of Kapton film and an outer protective layer of fiberglass reinforced silicone rubber. Author

N86-13709# California Univ., Santa Barbara. Dept. of Physics.
CHARGE-DENSITY WAVES OBSERVED WITH A TUNNELING MICROSCOPE Technical Report, 1 Feb. 1984 - 31 Jan. 1985
R. V. Coleman, B. Drake, P. K. Hansma, and S. Slough 1 Jul. 1985 9 p
(Contract N00014-78-C-0011)
(AD-A158779) Avail: NTIS HC A02/MF A01 CSCL 20/12

Charge-density waves on cleaved surfaces of 1T-TaS2 appeared at 77 K as hexagonal arrays of mounds with spacings of 3.5 + or - 0.3a(o) where a(o)=3.346A is the lattice spacing of the 1T-TaS2. In contrast, cleaved surfaces of 2H-TaSe2 at 77 K showed only atoms. The tunneling microscope was operated under liquid atoms. The tunneling microscope was operated under liquid nitrogen with a Pt(0.8)Ir(0.2) tip for both types of samples. Author (GRA)

N86-13710# Fame Associates, Inc., Fort Collins, Colo.
OPTICAL/INFRARED PROPERTIES OF ATMOSPHERIC AEROSOLS WITH AN IN SITU, MULTI-WAVELENGTH, MULTICHANNEL NEPHELOMETER SYSTEM Final Report, 15 Sep. 1984 - 14 Mar. 1985 on Phase 1

J. B. Wedding, Y. J. Kim, and M. A. Weigand Apr. 1985 63 p
(Contract F49620-84-C-0101)
(AD-A158825; FA-AF-14385; AFOSR-85-0506TR) Avail: NTIS HC A04/MF A01 CSCL 17/8

There exists a need to develop new instrumentation which can provide an in situ, real time measurement of the total differential scattering patterns from individual airborne particles of different composition and shape under natural and man-made atmospheric conditions. During the Phase 1 study, a literature survey was conducted, system requirements developed for an in situ, multi-wavelength, multichannel nephelometer system, and technical feasibilities were investigated. Finally, design parameters of the nephelometer system including the particle sampling inlet, the optical system, and the data acquisition system were optimized. The proposed nephelometer system will measure the differential scattering patterns of individual aerosol particles at three laser wavelengths, in three scattering planes. Successful development of such an instrument during the Phase 2 efforts will assist in filling the void of knowledge of the optical/infrared properties of atmospheric aerosols and their interactions with electromagnetic radiation fields. Author (GRA)

N86-13711# Aerospace Corp., El Segundo, Calif. Electronics and Optics Div.
RECTIFICATION AND REGISTRATION OF REMOTELY SENSED DATA Final Report
B. G. Kashef and A. A. Sawchuk 25 Jun. 1985 92 p Prepared in cooperation with University of Southern California, Los Angeles
(Contract F04701-83-C-0084)
(AD-A158827; TR-0084A(9975)-1; SD-TR-85-40) Avail: NTIS HC A05/MF A01 CSCL 17/9

An important problem in any onboard imaging system is the rectification and registration of images generated by onboard sensors. Accurate registration is a key requirement for detecting changes (in position, brightness, texture, boundary, etc.), from one sensed image to the next, as well as classification of data for intelligence gathering and vehicle guidance. This report discusses techniques of finding match points in pairs of images and performing geometric corrections and unwarping to compensate for systematic and random variations in the flight path, ephemeris, and sensor response. Techniques of resampling and interpolation of image data are reviewed, and the particular characteristics of sensors operating over a wide spectrum from visible through infrared and microwave are discussed. Particular attention is given to the rectification and registration of synthetic aperture radar (SAR) imagery, and several future study tasks on this specialized area are outlined. GRA

N86-13712# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
NEUTRON STRESS MEASUREMENTS WITH A POSITION SENSITIVE DETECTOR
A. D. Krawitz, P. J. Rudnik, B. D. Butler, and J. B. Cohen Aug. 1985 18 p
(Contract N00014-80-C-0116)
(AD-A158882; TR-20) Avail: NTIS HC A02/MF A01 CSCL 18/4

The feasibility of measuring residual and applied stresses with neutrons employing a position sensitive detector (PSD) is demonstrated. Measurements with both a small beam, to probe internal regions, and a large beam, for bulk sampling have been made. With such a detector collection of data is rapid compared to ordinary neutron collection methods. This detector allows more detailed sampling, smaller probe regions and possibly even study of time-dependent processes. The spectrometer geometry is shown. The detector consists of a three-counter array of linear PSD's spanning a usable angular range of 25 degrees 2 theta at a distance of 1220 mm from the sample position. The detectors are stacked in a vertical plane which is normal to the horizontal diffraction plane. The front of the detector housing has an oscillating radial collimator which greatly reduces background and off-axis scattering. The data is rebinned into 0.1 degrees 2 theta increments from the basic channel width of approximately 0.03 degrees and the intensity of the three detectors is added. From these experiments we have shown that the PSD in use at the University of Missouri Research Reactor Facility is an important tool for the application of neutron scattering to engineering materials, in addition to its use in more traditional neutron scattering experiments. This is because of the significant savings in data collection time and the increased range of feasible experiments. The resolution and behavior of this instrument has been demonstrated to be on a par with standard detectors. GRA

N86-13713# North Carolina Univ., Chapel Hill. Inst. of Statistics.
A NOTE ON THE EFFECT OF IGNORING SMALL MEASUREMENT ERRORS IN PRECISION INSTRUMENT CALIBRATION Technical Report, Sep. 1984 - Sep. 1985
R. J. Carroll and C. H. Spiegelman Jun. 1985 17 p
(Contract F49620-82-C-0009)
(AD-A159104; MIMEO-SER-1580; AFOSR-85-0701TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The authors' focus is the simple linear regression model with measurement errors in both variables. It is often stated that if the measurement error in x is small, then we can ignore this error and fit the model to data using ordinary least squares. There is some ambiguity in the statistical literature concerning the exact meaning of a small error. For example Draper and Smith (1981) state that if the measurement error variance in x is small relative to the variability of the true x's, then errors in the x's can be effectively ignored, see Montgomery and Peck (1983) for a similar statement. Scheffe (1983) and Mandel (1984) argue for a second criterion, which may be informally summarized that the error in x should be small relative to (the standard deviation of the observed Y about the line)/(slope of the line). We argue that for calibration experiments both criteria are useful and important, the former for estimation of x given Y and the latter for confidence intervals for x given Y. Author (GRA)

N86-13714# Department of the Navy, Washington, D. C.
AN OIL/WATER DISPERSER DEVICE FOR USE IN AN OIL CONTENT MONITOR/CONTROL SYSTEM Patent Application
F. D. Kempel, inventor (to Navy) Filed 2 Jul. 1985 17 p
(AD-D011868; US-Patent-Appl-SN-751347) Avail: NTIS HC A02/MF A01 CSCL 13/2

This patent application discloses an oil content monitor/control unit system, including an oil/water disperser device, which is configured to automatically monitor and control processed effluent from an associated oil/water separator so that if the processed effluent exceeds predetermine in-port or at-sea oil concentration lmits, it is either recirculated to an associated oil/water separator via a ship's bilge for additional processing, or diverted to a holding tank for storage. On the other hand, if the oil concentration of the processed effluent is less than predetermine in-port or at-sea limits, it is discharged overboard. The oil/water disperser device is configured to break up any oil present in the processed effluent into uniform droplets for more accurate sensing of the oil present in the processed effluent into uniform droplets for more accurate sensing of the oil-in-water concentration level thereof. The oil/water disperser device has a flow-actuated variable orifice configured into a spring-loaded polyethylene plunger which provides the uniform distribution of oil droplets. GRA

N86-13715# Department of the Navy, Washington, D. C.
TIME RESOLVED EXTENDED X-RAY ABSORPTION FINE STRUCTURE SPECTROMETER Patent Application
H. W. Huang, inventor (to Navy) Filed 17 May 1985 19 p
(AD-D011869; US-Patent-Appl-SN-734986) Avail: NTIS HC A02/MF A01 CSCL 20/6

The present invention relates to an X-ray spectrometer for obtaining EXAFS data from a target material. The target material is exposed to incident pulsed synchrotron/X-ray radiation having a selected range of continuous spectrum and intensity suitable for obtaining EXAFS data from the material. The transmitted or fluorescence X-rays is detected and integrated over a period of time. The integrator is controlled by a rate synchronous with the

pulsed radiation. The integration time of the integrator can be varied. A xenon flash is provided for exciting appropriate materials and is controlled by a gating device which is also synchronized with the radiation pulses. Author (GRA)

N86-13716# Department of the Navy, Washington, D. C.
EXPENDABLE BATHYTHERMOGRAPH FOR MEASURING LIGHT ATTENUATION AND TEMPERATURE BELOW THE OCEAN SURFACE Patent Application
C. H. Sinex and B. E. Raff, inventors (to Navy) Filed 12 Jun. 1985 13 p
(AD-D011870; US-Patent-Appl-SN-744084) Avail: NTIS HC A02/MF A01 CSCL 08/10

An expendable bathythermograph sensor is modified to include a fiber optic light pipe mounted thereon to carry incident light to a photodiode unit located inside the sensor. A thermistor is mounted on the sensor, and the photodiode unit includes multiplexed electronics for transmitting both optical and temperature data to measure temperature and light as a function of ocean depth. GRA

N86-13717# Department of the Navy, Washington, D. C.
OIL CONTENT MONITOR/CONTROL SYSTEM AND METHOD Patent Application
R. F. Schmitt, J. A. Gavin, F. D. Kempel, and C. N. Waltrick, inventors (to Navy) Filed 2 Jul. 1985 17 p
(AD-D011871; US-Patent-Appl-SN-751346) Avail: NTIS HC A02/MF A01 CSCL 13/2

This patent application discloses an oil content monitor/control unit system which is configured to automatically monitor and control processed effluent from an associated oil/water separator so that if the processed effluent exceeds predetermined in-port or at-sea oil concentration limits, it is either recirculated to an associated oil/water separator via a ship's bilge for additional processing, or diverted to a holding tank for storage. On the other hand, if the oil concentration of the processed effluent is less than determined in-port or at-sea limits, it is discharged overboard. GRA

N86-13718# Department of the Navy, Washington, D. C.
REMOTE OPTICAL CRACK SENSING SYSTEM Patent Application
S. L. Huang, A. Scotese, and M. Libeskind, inventors (to Navy) Filed 12 Oct. 1984 12 p
(AD-D011872; US-Patent-Appl-SN-660349) Avail: NTIS HC A02/MF A01 CSCL 14/2

An apparatus is disclosed for remotely detecting cracks of sub-critical length which originate from stress raisers in structural material, wherein the apparatus typically comprises a source of light, a continuous length of optical fiber to conduct the light, strain responsive devices coupled to the fiber and bonded to the structural member in close proximity to the stress raisers, and a light responsive detector which is optically coupled to the fiber in order to detect breaks in the fiber induced by either tensile or shear forces eminating from cracks around the stress raisers. Author (GRA)

N86-13719# Department of the Navy, Washington, D. C.
VARIABLE TEMPERATURE TRAP Patent Application
C. Clavell, Jr., inventor (to Navy) Filed 21 Jun. 1985 10 p
(AD-D011874; US-Patent-Appl-SN-747220) Avail: NTIS HC A02/MF A01 CSCL 08/10

Heretofore, arriving at reliable figures for determination of organotin compound concentrations has been hampered due to the lack of a suitable device for trapping the compounds and making an analysis or detection of their presence and concentration. This has been particularly true in the case of seawater analysis where some of the organotin compounds have been leached into seawater from various anti-fouling coatings. The present invention is directed to providing an apparatus responsive to an external control for enabling a precise analysis of organotins in a gas sample by a detector. An elongate glass tube containing a small amount of granular absorbent material held between quartz fiber plugs is coupled to receive the gas sample and concentrate the organotins, as well as being coupled to the detector for subsequent elution. An elongated temperature probe coaxially extends through the longitudinal chamber and into the absorbent material to provide an indication of temperature to the external control. A liquid nitrogen container is shaped to contain the portion of the elongated tube having the longitudinal chamber to lower the chamber's temperature below the temperature required for concentrating the organotins. A helically wound coil about the outside of the elongated tube heats the longitudinal chamber so that at discrete temperature levels a separation is effected and the organotins of interest are eluted from the chamber to the detector thereby allowing a precise analysis of the organotins of interest. GRA

N86-13720# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
SPECIALIZED INSTRUMENT FOR RADIATION ASSISTANCE TEAMS
J. A. Applegate Aug. 1985 9 p
(Contract DE-AC04-76DP-00487)
(DE85-017390; MHSMP-85-39) Avail: NTIS HC A02/MF A01

A specialized multiradiation instrument for radiation assistance teams (RAT's) has been designed; a working prototype has been constructed and field tested. The instrument detects alpha, beta, and gamma radiation simultaneously with simple red, yellow, and green meter indications and audio outputs. It is basically intended for DOE radiation assistance teams but would have application to any government, military, or industrial radiation accident team. DOE

N86-13721# Sandia National Labs., Albuquerque, N. Mex.
HIGH SPEED MULTI-CHANNEL DATA RECORDER TO REPLACE OSCILLOSCOPE DATA ACQUISITION SYSTEMS
W. F. Filter, J. Chang, C. O. Landron, G. J. Lockwood, D. J. Muron, B. T. Neyer, and L. E. Ruggles 1985 17 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015155; SAND-84-2545C; CONF-850616-70) Avail: NTIS HC A02/MF A01

A photonic high speed analog data recording system previously developed in our laboratory was used for the first time in the operational environment of a large pulsed power accelerator. A retrofit capability of this system is demonstrated by recording waveforms from analog electrical sensors using laser diode transmitters. A key component of the system, a prototype High Speed Multi-Channel Data Recorder, and its application on the Sandia HydraMITE II accelerator are described. DOE

N86-13722# Department of Energy, Washington, D. C.
APPARATUS FOR REMOVABLY HOLDING A PLURALITY OF MICROBALLOONS Patent Application
E. S. Jorgensen, inventor (to DOE) Filed 5 Jun. 1984 9 p
(Contract W-7405-eng-36)
(DE85-006517; US-Patent-Appl-SN-617657) Avail: NTIS HC A02/MF A01

The present invention relates generally to the manipulation of microballoons and more particularly to an apparatus for removably holding a plurality of microballoons in order to more efficiently carry out the filling of the microballoons with a known quantity of gas. DOE

N86-13723# Lawrence Livermore National Lab., Calif.
PHOTOELECTRONIC TRAJECTORY ANATOMY OF RCA-C-73435 IMAGE CONVERTER AND ITS PERFORMANCE
C. C. Lai, L. B. Olk, and R. D. Lear 7 Jun. 1985 6 p refs Presented at the IEEE Conf. on Photoelectron. Imaging, London, 10 Sep. 1985
(Contract W-7405-eng-48)
(DE85-013973; UCRL-91699; CONF-8509104-1) Avail: NTIS HC A02/MF A01

A two dimensional electron optics code, which fully incorporates space charge and self magnetic effects, was used to compute the photoelectronic trajectories in a RCA-C-73435 image converter streak tube. The code reveals the beam trace formations in graphic

detail, as well as provides numerical data on static and dynamic imaging parameters, including focused field profile, spatial resolution, linear distortion, transit time dispersion and chromatic aberration. These computational results correlate qualitatively with the experimental ones obtained under corresponding conditions. The study thus establishes a set of computer simulation estimates on tube performance as a function of the electron emitting characteristics at the photocathode and as a function of the electrode voltages. DOE

N86-13724# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC STUDY OF THE PARTICLES PRODUCED BY THE INJECTOR IN A VIKING MOTOR [ETUDE HOLOGRAPHIQUE DE LA PULVERISATION PRODUITE PAR UN INJECTEUR DE MOTEUR VIKING]
H. Royer 29 May 1984 40 p refs In FRENCH
(ISL-R-111/84) Avail: NTIS HC A03/MF A01

A microholographic study of the jet of particles produced by the injector on the Ariane launcher is discussed. The experimental set-up included the utilization of a single beam laser. The study was made in order to investigate combustion instabilities in the Ariane motors. The results from 4 holograms show a Rosin Rammler distribution law with modes at 60 and 200 microns. Author (ESA)

N86-13725# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
DEVELOPMENT OF A BREADBOARD COOLER FOR INFRARED REMOTE SENSING PAYLOADS, PHASE 2 Final Report
N. P. Enderberg and E. G. Overbosch Paris ESA May 1984 86 p refs
(Contract ESTEC-4620/81/NL-PP)
(FOK-RV-R-82-072; ESA-CR(P)-1934) Avail: NTIS HC A05/MF A01

The major components of an IR sensor cooler were studied. First and second-stage straps manufactured from glass fiber reinforced plastic pass static and dynamic tests, although the second-stage straps were more critical. Pretensioning problems during assembly of second-stage straps in the cooler were solved. The integrated second-stage suspension passes static, sine-vibration and random vibration tests. The parabolic mirror was made by electroforming on a precision-turned parabolic mandril. Representative flat samples were prepared and optically tested to develop the most appropriate electroforming technique. A full size mandril (die) and mirror were manufactured. Samples of open faced honeycomb were prepared to represent the second-stage radiator. An increased number of sprayed layers with black paint gives the best result. Emittance tests confirm the expected epsilon increase of the emitting area. Author (ESA)

N86-13726# Office of Radiation Programs, Las Vegas, Nev.
REPORT ON AN AUTOMATED CALIBRATION RANGE FOR BROADBAND ISOTROPIC PROBES
J. Johnson Jun. 1985 143 p
(PB85-231470; EPA-520/6-85-021) Avail: NTIS HC A07/MF A01 CSCL 14B

The construction of an automated absolute field generation system using standard gain horns and an anechoic range is discussed. The system operates in the frequency range of 1.12 to 26.5 GHz. The primary purpose of the range is automated evaluation of the frequency response and isotropy of various commercially available microwave hazard survey meters. GRA

N86-13727# Rockwell International Corp., Thousand Oaks, Calif.
DEVELOPMENT AND EVALUATION OF AN INSTANTANEOUS ATMOSPHERIC CORROSION RATE MONITOR Final Report
F. Mansfeld, S. L. Jeanjaquet, M. W. Kendig, and D. K. Roe Jun. 1985 84 p Prepared in cooperation with Portland State Univ., Oreg.
(Contract EPA-68-02-3741)
(PB85-214336; EPA-600/3-85-048) Avail: NTIS HC A05/MF A01 CSCL 14B

A research program was carried out in which a new instantaneous atmospheric corrosion rate monitor (ACRM) was developed and evaluated, and equipment was constructed which will allow the use of many sensors in an economical way in outdoor exposures. In the first task, the ACRM was developed and tested in flow chambers in which relative humidity and gaseous and particulate pollutant levels can be controlled. Diurnal cycles and periods of rain were simulated. The effects of aerosols were studied. A computerized system was used for collection, storage, and analysis of the electrochemical data. In the second task, a relatively inexpensive electronics system for control of the ACRM and measurement of atmospheric corrosion rates was designed and built. In the third task, calibration of deterioration rates of various metallic and nonmetallic materials with the response of the ACRMs attached to these materials was carried out under controlled environmental conditions using the system developed in the second task. A Quality Assurance project plan was prepared with inputs from the Rockwell International Environmental Monitoring and Service Center and Quality Assurance System audits were performed. GRA

N86-14169# Joint Publications Research Service, Arlington, Va.
DETERMINING FLEXURE OF AERIAL CAMERA SMOOTHING GLASS Abstract Only
V. N. Lavrov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 107 Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 11, Nov. 1984 p 30-33 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-13728# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
CONCEPT OF LASER LOCATOR SYSTEMS (BASED ON THE GEOMETRY OF THE TRIANGULAR CORNER CUBE REFLECTOR)
H. B. Holl May 1985 95 p
(AD-A157795; AD-E950723; AMSMI/RE-85-12-TR) Avail: NTIS HC A05/MF A01 CSCL 17/3

This report provides a brief discussion of a concept for Laser Locator Systems, and for measuring the horizontal and vertical aspect angles of radiation received from a remote laser transmitter. The systems are grouped in retroreflecting systems and non-retroreflecting systems. The non-reflecting systems are subdivided in three-mirror systems and two-mirror systems, of which the last systems have either two parallel located detector arrays, or orthogonally located linear detector arrays. The radiation receiving components are a triangular corner cube reflector, or sets of dihedral mirrors, or flat-strip mirrors. The concept is useful for radiation from the visible to the millimeter wavelength region for a single pulse or continuous radiation, and is insensitive to hot spots in the radiation. Author (GRA)

N86-13729# Physical Sciences, Inc., Andover, Mass.
EXPERIMENTAL AND THEORETICAL STUDIES OF LASER PROPULSION PHENOMENOLOGY Final Technical Report, 15 Jan. 1984 - 28 Feb. 1985
D. Rosen, G. Caledonia, N. Kemp, R. Krech, and L. Cowles Mar. 1985 37 p
(Contract F49620-83-C-0039)
(AD-A158273; PSI-039; TR-505; AFOSR-85-0577TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

The work performed in this 2-year effort involved two tasks: one dealing with issues related to laser energy absorption in a pulsed thruster and the other dealing with issues related to laser energy absorption in a CW thruster. For the pulsed studies, the first year's effort involved theoretical and experimental investigations of the threshold requirements for achieving laser-induced

gas breakdown at short wavelengths (< 1 micrometer). With these breakdown studies completed, the next step, initiated in the second year, was to determine the degree of pulsed laser energy absorption that can be achieved in the laser-initiated plasma. Toward this end pulsed laser energy deposition studies were performed using a pulsed Nd:glass laser as the energy source (wavelength = 1.05 micrometers, pulse duration = 20 ns) and high pressure hydrogen and argon gases as the absorption media. The percentage of laser energy absorbed in the laser-produced plasma was determined from measurements of the fraction of laser energy transmitted through the breakdown region, as well as from optical interferometric measurements to determine the strength of the laser-produced blast wave. The initially deposited energy was inferred from the measured blast wave trajectories by comparing them with predicted trajectories calculated by a detailed hydrodynamic model. Results are presented for the energy deposition efficiency achieved in argon and hydrogen as a function of initial gas pressure (0.3 atm < P < 10 atm). GRA

N86-13730# Battelle Columbus Labs., Ohio.
LASER PRODUCED X-RAY FOR HIGH RESOLUTION LITHOGRAPHY Annual Report, 15 Dec. 1983 - 14 Dec. 1984
H. M. Epstein 17 Apr. 1985 42 p
(Grant AF-AFOSR-0066-82)
(AD-A158734; AFOSR-85-0501TR) Avail: NTIS HC A03/MF A01 CSCL 14/5

During the past year the research effort was concentrated on the rapidly pulsed laser-plasma X-ray source. The effort was divided into three areas: developing the source and system, studying improved diagnostic, and making accurate X-ray measurements over a parameter matrix. GRA

N86-13731# Saint John Fisher Coll., Rochester, N.Y. Dept. of Physics.
MULTILEVEL RELAXATION PHENOMENA AND POPULATION TRAPPING Report, 1 Jul. 1984 - 30 Jun. 1985
F. T. Hioe Apr. 1985 4 p refs
(Contract DE-FG02-84ER-13243)
(DE85-011527; DOE/ER-13243/1) Avail: NTIS HC A02/MF A01

New analytic results have been found for a wide variety of atomic excitation processes which involve the use of amplitude and frequency modulated laser pulses. Our analytic solutions apply equally to mathematically analogous atomic collision problems. DOE

N86-13732# Rochester Univ., N. Y. Lab. for Laser Energetics.
ACTIVE MIRROR BOOSTED 351 nm LASER IRRADIATION FACILITY
T. Kessler, R. Bahr, W. Seka, J. M. Soures, and J. Kelly 1985 6 p Presented at the Conf. on Lasers and Electro-Optics, Baltimore, 21 May 1985
(Contract DE-FC08-85DP-40200)
(DE85-014412; DOE/DP-40124/71(1); CONF-850558-4) Avail: NTIS HC A02/MF A01

The Glass Development Laser, a single beam, frequency tripled Nd:phosphate glass laser, has been upgraded with 25 cm active mirror amplifiers to generate in excess of 300 joules in 1 nsec at 1054 nm and 200 joules at 351 nm. The system design and performance is discussed. DOE

N86-13733# Rochester Univ., N. Y. Lab. for Laser Energetics.
RETROFIT OF A HIGH POWER Nd:GLASS LASER SYSTEM WITH LIQUID CRYSTAL POLARIZERS
S. D. Jacobs, K. A. Ceruga, T. J. Kessler, W. Seka, and R. Bahr Mar. 1985 9 p Presented at the Boulder Damage Symp., Boulder, Colo., 15 Oct. 1984
(Contract DE-FC08-85DP-40200)
(DE85-014415; DOE/DP-40200/07; CONF-8410276-3; Rept-163) Avail: NTIS HC A02/MF A01

The glass development laser (GDL), has been operating at the Laboratory for Laser Energetics since 1978. This Nd:phosphate glass system produces high peak power optical radiation at lambda = 1054 nm or lambda = 351 nm for use in studying the interaction physics of intense laser beams with matter. The amplifier staging incoroprates the propagation of linearly and circularly polarized light in rod amplifiers which vary in diameter from 16 nm to 90 mm. Numerous quartz or mica quarter waveplates and Brewster angle dielectric thin film polarizers are required to limit accumulated phase retardation between amplification stages and to accommodate interstage Pockels' cell isolation switches. We have recently replaced most of the waveplate dielectric polarizer combinations in GDL with liquid crystal polarizers. Comprised of 11 (MU)m thick cholesteric fluids sandwiched between optical quality glass plates, liquid crystal polarizers provide excellent polarization properties, low insertion loss, angular insensitivity, and laser damage resistance at lambda = 1054 nm. The design, fabrication, and performance of left handed and right handed circular polarizers will be discussed. DOE

N86-13452# Joint Publications Research Service, Arlington, Va.
EXTREMELY HIGH REFLECTIVE CAPABILITY OF ZIRCONIUM BURNING IN AIR UNDER EFFECTS OF CONSTANT CO2 LASER RADIATION Abstract Only
O. G. Buzykin, A. V. Burmistrov, M. N. Kogan, V. I. Konov, A. M. Prokhorov, and V. G. Ralchenko *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 22 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 4, Apr. 1983 p 779-782 Original language document was announced in IAA as A85-35470 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13454# Joint Publications Research Service, Arlington, Va.
CERTAIN FEATURES OF LASER DESTRUCTION AND DISLOCATIONAL STRUCTURE OF SILICON DURING HEATING AND EFFECTS OF ELECTRICAL FIELD Abstract Only
M. S. Bakharev, A. A. Gorbachev, L. I. Mirkin, a. S. Mokh, and R. R. Sheverdova *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 23-24 Transl. into ENGLISH from Fiz. i Khim. Obrabotki Mater. (Moscow), no. 2, Mar. - Apr. 1985 p 37-40 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13548# Tennessee Univ., Tullahoma. Center for Laser Applications.
LASER THERMAL PROPULSION Abstract Only
Dennis Keefer, Carroll Peters, Herbert Crowder, and Richard Wells *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13549# Pennsylvania State Univ., University Park.
ANALYTICAL MODELING OF STRONG RADIATION GASDYNAMIC INTERACTION Abstract Only
Charles L. Herkle *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13550# Illinois Univ., Urbana-Champaign.
EXPERIMENTAL STUDIES OF LASER-SUSTAINED ARGON PLASMAS FOR CW LASER PROPULSION APPLICATIONS Abstract Only
Herman KRier and Jyoti Mazumder *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13551# Physical Sciences, Inc., Andover, Mass.
LINEAR AND SATURATED ABSORPTION OF LASER RADIATION IN HEATED CASES Abstract Only
Robert H. Krech, Lawren M. Cowles, George E. Caledonia, and David I. Rosen *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13552# Physical Sciences, Inc., Andover, Mass.
ENERGY DEPOSITION OF PULSED ONE MICRON LASER RADIATION IN H2 AND AR Abstract Only
David I. Rosen and Nelson H. Kemp *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13571# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
DEVELOPMENT OF VELOCITY MEASUREMENT TECHNIQUE BY PULSED LASER DOPPLER ANEMOMETRY Abstract Only
B. C. R. Ewan and J. Swithenbank *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13572# Stanford Univ., Calif. Dept. of Mechanical Engineering.
QUANTITATIVE FLOW VISUALIZATION Abstract Only
Ronald K. Hanson *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 5 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13575# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
THE 1-D LASER DOPPLER INSTRUMENTATION Abstract Only
Holger T. Sommer *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13578# Yale Univ., New Haven, Conn. Center for Laser Diagnostics.
LASER EMISSION AND COHERENT RAMAN SCATTERING FROM INDIVIDUAL FLOWING DROPLETS Abstract Only
Richard K. Chang, Marshall B. Long, and Roman Kuc *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13579# Yale Univ., New Haven, Conn. Center for Laser Diagnostics.
SIZE AND SHAPE CHARACTERIZATION OF INDIVIDUAL FLOWING DROPLETS BY LASER LIGHT SCATTERING Abstract Only
Richard E. Chang, Boa-Teh Chu, and Marshall B. Long *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13581# Arizona State Univ., Tempe.
INTELLIGENT LASER DIFFRACTION INSTRUMENTATION FOR PARTICLE SIZE ANALYSIS Abstract Only
E. Dan Hirleman and Joseph I. Koo *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13609# Joint Publications Research Service, Arlington, Va.
PULSED, OPTICALLY PUMPED GAS-MIXTURE FIR LASERS
Pan Chengzhi, Han Shaoping, Qin Yi, Hou Qiguo, and Liu Xiuyun *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 122-125 refs Transl. into ENGLISH from Dianzi Chengzhi (Beijing), v. 13, no. 1, Jan. 1985 p 117-119 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-13611# Joint Publications Research Service, Arlington, Va.
FRG'S DORNIER DEVELOPS HIGH-RESOLUTION DISPLAY SYSTEM
Hans-Peter Engelhardt *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 28 Oct. 1985 p 17-20 Transl. into ENGLISH from Dornier Post (West Germany), no. 4, 1984 p 21-23 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

N86-13620# Joint Publications Research Service, Arlington, Va.
CNET OF FRANCE USES ORGANO-METALLIC EPITAXY FOR LASER
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 8 Nov. 1985 p 30-31 Transl. into ENGLISH from Electron. Actualites (Paris), 22 Mar. 1985 p 26 (For primary document see N86-13616 04-31)
Avail: NTIS HC A03/MF A01

N86-13774# Joint Publications Research Service, Arlington, Va.
STUDY OF OPTICAL-ACOUSTICAL PHENOMENA AT SURFACE OF STRONGLY ABSORBING CLEARING FLUIDS Abstract Only
F. V. Bunkin, K. L. Vodopyanov, L. A. Kulevskiy, G. A. Lyakhov, V. G. Mikhalevich, and A. M. Rodin *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 18 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 558-563 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-13734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF TRACTION DRIVES
Stuart H. Loewenthal and Erwin V. Zaretsky Oct. 1985 49 p refs Submitted for publication
(NASA-RP-1154; E-2143; NAS 1.61:1154) Avail: NTIS HC A03/MF A01 CSCL 13I

Traction drives are among the simplest of all speed-changing mechanisms. Because of their simplicity and their ability to smoothly and continuously adjust speed, they are excellent choices for many drive system applications. They have been used in industrial service for more than 100 years. Today's traction drives have power capacities which rival the best gear and belt drives due to modern traction fluids and highly fatigue-resistant bearing steels. This report summarizes methods to analyze and size traction drives. Lubrication principles, contact kinematics, stress, fatigue life, and performance prediction methods are presented. The effects of the lubricant's traction characteristics on life and power loss are discussed. An example problem is given which illustrates the effects of spin on power loss. Loading mechanism design and the design of nonlubricated friction wheels and rings are also treated. Author

N86-13735*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Engineering Mechanics.
KINEMATICS OF FOLDABLE DISCRETE SPACE CRANES Final Report
Adnan H. Nayfeh 26 Nov. 1985 26 p
(Grant NsG-1185)
(NASA-CR-176360; NAS 1.26:176360) Avail: NTIS HC A03/MF A01 CSCL 13I

Exact kinematic description of a NASA proposed prototype foldable-deployable discrete space crane are presented. A computer program is developed which maps the geometry of the crane once controlling parameters are specified. The program uses a building block type approach in which it calculates the local coordinates of each repeating cell and then combines them with respect to a global coordinates system. Author

N86-13736# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
FUSION WELDING RESEARCH Annual Technical Report
T. W. Eagar, G. B. Hunter, C. D. Allemand, A. Block-Bolten, and G. J. Dunn 30 Apr. 1985 43 p

(Contract N00014-80-C-0384)
(AD-A158253; ATR-5) Avail: NTIS HC A03/MF A01 CSCL 13/8

This report summarizes progress in fundamental research on welding processes. Studies include: metal vapors in the arc; development of a high speed infrared temperature monitor; digital signal analysis as a weld process monitor; convection in arc weld pools; droplet transfer and contact tip wear in gas metal arc welding of titanium; and fracture toughness of HY-80 weldments. GRA

N86-13737# Department of the Navy, Washington, D. C.
LATCH FOR DETACHABLY SECURING ELECTRONIC CARDS ALONG ORTHOGONAL LOADING AXES Patent Application
S. J. Kreta and J. J. Honn, inventors (to Navy) Filed 24 Jun. 1985 9 p
(AD-D011885; US-Patent-Appl-SN-748094) Avail: NTIS HC A02/MF A01 CSCL 13/5

The present invention relates to a latch for detachably securing electronics cards along orthogonal loading axes. A planar fixed gate is rigidly securable to an external supporting structure and is provided with at least one elongated protrusion extending above one of the planar surfaces. A planar movable gate is rigidly securable to an external electronics mountable structure wherein said movable gate is provided with at least one elongated groove on a planar surface. The planar fixed gate and the planar movable gate are abuttingly engagable to each other with the protrusion matingly fitted within the corresponding groove. The orientation of the protrusion and groove are orthogonal to an axis of a first loading force applicable to the moving gate. A fastener such as a threaded bolt rigidly maintains the planar surfaces of the fixed gate in engagement with the movable gate for rigid support along a second loading axis orthogonal to the first loading axis. Author (GRA)

N86-13738# European Space Tribology Lab., Risley (England).
[ACTIVITIES REPORT IN SPACE TRIBOLOGY] Progress Report, 1984
M. J. Todd Paris ESA Jan. 1985 16 p refs
(Contract ESTEC-5615/83/NL-PP)
(ESA-ESTL-72; ESA-CR(P)-2043) Avail: NTIS HC A02/MF A01

Spacecraft mechanism and lubrication tests are summarized. Solar array mechanisms; the Giotto despin mechanism; lead film lubrication; slip ring technology; oils and greases; MOS2 films; gears; lead ion-plated bearings; and fluid lubrication are studied. Author (ESA)

N86-13739# Consulenze Generali Roma (Italy).
CYCLOSYMMETRIC APPROACH TO THE DYNAMICS OF REPETITIVE MODULAR STRUCTURES Final Report
Carlo Arduini and Silvano Sgubini Paris ESA Nov. 1984 403 p refs
(Contract ESTEC-5260/82/NL-PB(SC))
(ESA-CR(P)-2062) Avail: NTIS HC A18/MF A01

The basic theory of cyclosymmetric analysis of modular repetitive structures is introduced. The approach consists of transforming the problem of an N bays structure, with n degrees of freedom each, from an (N.n) degrees of freedom problem to N problems of smaller dimension (e.g., of order n). This is possible for ring type boundary conditions by discrete Fourier transformation. Extension to dynamic response problems and to quasi modular structures is outlined. Author (ESA)

N86-13740# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
[ACTIVITIES REPORT OF THE TECHNICAL AND SCIENTIFIC RESEARCH CENTER FOR THE METAL MANUFACTURING INDUSTRY] Annual Report, 1984 [RAPPORT ANNUEL DU COMITE PERMANENT AU CONSEIL GENERAL]
5 Jun. 1985 56 p refs In FRENCH
Avail: NTIS HC A04/MF A01

The research subjects include computerized simulation, metal casting, computer aided design and manufacturing, metallic structures, vessel manufacturing, steel welding, numerical control, flexible manufacturing systems, robotics, automation, and plastics manufacturing. Author (ESA)

N86-13741# Centre Technique des Industries Mecaniques, St. Etienne (France).
COMPUTERIZED SIMULATION AND DISPLAY OF EXTRUDING BY COLD FORGING Final Report [OPTIMIZATION DES PROGRAMMES DE FILAGE MIXTE]
Jean Francois Renaudin and Henri Jean Braudel (Ecole des Mines de Paris, Sophia Antipolis, France) Dec. 1983 117 p refs In FRENCH
(Contracts CETIM-4-79-6122; CETIM-4-77-5310)
(CETIM-1-3L-11-1) Avail: NTIS HC A06/MF A01

Computer programs in FORTRAN 4 were developed to study metal flow in combined cold extrusion of metals. The experimental determination of rheological material properties is required. The programs are named Filmix, Fildr and Filtub. They refer to three procedures to obtain axisymetric bodies. Experimental tests on XC10 steel validate the Filmix program. The tests show the influence of the rheological and tribological parameters. Author (ESA)

N86-13742# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
29 Oct. 1985 88 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-85-014) Avail: NTIS HC A05/MF A01

Articles from journals and other publications of the U.S.S.R. on machine tools and metalworking equipment are presented. They are divided into areas on industry planning and economics, metal cutting and metal forming machine tools, automated lines and aggregated machining systems, and robotics. For individual titles, see N86-13743 through N86-13744.

N86-13743# Joint Publications Research Service, Arlington, Va.
NEW APPLICATIONS OF INDUSTRIAL ROBOTS NOTED
L. Volchkevich *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-014) 29 Oct. 1985 p 76-79 Transl. into ENGLISH from Izv. (Moscow), 3 Jun. 1985 p 2 (For primary document see N86-13742 04-37)
Avail: NTIS HC A05/MF A01

In recent years new trends in robotics have appeared. The first of these is the switch from loading/transport to industrial robots. These do not merely imitate human actions, but enable both a faster and better performance of industrial operations. The assortment of such operations is rather large: spot and seam welding, cutting, soldering, cleaning of surfaces, removal of burr, painting, and application of galvanic coatings. The foremost achievement here is the improved quality of production through more precise adherence to operating conditions than is possible with manual labor. Productivity is also boosted. The second trend is the switch from hydraulic drive to electromechanical and the development of designs with a great variety of movements. Author

N86-13744# Joint Publications Research Service, Arlington, Va.
PROBLEMS WITH INTEGRATING ROBOTS IN CONVENTIONAL PRODUCTION
Ivan Vasilyevich Vorotyntsev *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-014) 29 Oct. 1985 p 80-83 Transl. into ENGLISH from Moskov. Pravda (Moscow), 15 Nov. 1984 p 2 (For primary document see N86-13742 04-37)
Avail: NTIS HC A05/MF A01

An interview with a director of a grid and boring machine plant is presented. In the last three years, production at his plant has increased by 27 percent and labor productivity by 20 percent. There are a number of reasons for these increases, in particular the high technical level of production and the development of robotics. The integration of these robots with human workers is discussed, as well as the economic impact and the psychological factors. E.R.

N86-13745# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
16 Oct. 1985 95 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-85-013) Avail: NTIS HC A05

Industry planning and economics, metal cutting and metal forming machine tools, robots, process controls and automation electronics, and technology planning and management automation are some areas into which the articles from Soviet journals and other publications are divided. Some titles of articles presented are: New Efforts to Intensify Machine Tool Production; Machine Tools Made In-House to Modernize Production; Determination of Effective Placement of Equipment in Flexible Automated Production Systems; Robot Control System Modified for Precision Movement; and Active Monitoring of Tool Wear by Acoustical Emissions. For individual titles, see N86-13746 through N86-13748.

N86-13746# Joint Publications Research Service, Arlington, Va.
PROBLEMS WITH ROBOTIZATION OF CONVENTIONAL SHOPS
V. Chernomorskiy *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-013) 16 Oct. 1984 p 69-73 Transl. into ENGLISH from Pravda Vostoka (Tashkent, USSR), 14 Jul. 1985 p 2 (For primary document see N86-13745 04-37)
Avail: NTIS HC A05

The experiences of robotizing an industrial reactor plant in the U.S.S.R. is presented. The physical environment is discussed: how to accommodate their size. How to gain more use from them is briefly discussed. And how to integrate them with people is also discussed. E.R.

N86-13747# Joint Publications Research Service, Arlington, Va.
ROBOT CONTROL SYSTEM MODIFIED FOR PRECISION MOVEMENT
P. M. Kuznetsov and M. L. Popov *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-013) 16 Oct. 1985 p 74-77 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Mash. (Moscow), no. 7, Jun. 1985 p 140-143 (For primary document see N86-13745 04-37)
Avail: NTIS HC A05

Questions of automating the robotized assembly of precision cylindrical joints under flexible automated production (GAP) are examined. As indicated by research that was performed, precision in the positioning of existing robot designs does not enable the indicated operation to be performed under GAP conditions. The potential of using additional devices with a view to resolving this task is examined. A specific route is proposed. An arrangement that provides for precision in the motion of mated surfaces is examined. Author

N86-13748# Joint Publications Research Service, Arlington, Va.
NEW ROBOTS BY SOVIET, CEMA MANUFACTURERS DESCRIBED
L. Eygel *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-013) 16 Oct. 1985 p 78-83 Transl. into ENGLISH from Mater.-Tekhnicheskiye Snabzheniye (Moscow), no. 6, Jun. 1985 p 64-67 (For primary document see N86-13745 04-37)
Avail: NTIS HC A05

Right now integrated mechanization and automation of production processes are being introduced widely and worker manpower engaged in manual labor is being reduced steadily, especially in auxiliary operations. Means for programmed positional control, which are called industrial robots, are being applied to loading, unloading and warehouse transporting operations. These industrial robots and their manufacture are described. Author

N86-13483# Joint Publications Research Service, Arlington, Va.
POSSIBLE MECHANISM OF WAVE FORMATION DURING DETONATION WELDING Abstract Only
S. V. Bazdenko, V. F. Demichev, D. Kh. Morozov, and O. P. Pogutse *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006-) 29 Jul. 1985 p 60 Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), v. 21, no. 1, Jan. - Feb. 1985 p 130-137 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13484# Joint Publications Research Service, Arlington, Va.
OPTIMIZATION OF TECHNOLOGICAL PARAMETERS OF COLD PRESSURE WELDING OF AD1M THIN ALUMINUM SHEETS Abstract Only
V. F. Kuzin, Yu. V. Savinkin, M. N. Tsypona, Ye. A. Kozelo, and M. A. Arkhangelskiy *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 61 Transl. into ENGLISH from Svarochnoye Proizv. (Moscow), no. 4, Apr. 1985 p 9-11 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13625# Joint Publications Research Service, Arlington, Va.
DIRECT INJECTION DIESEL MOTOR
R. Margary *In its* West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 18-31 Transl. into ENGLISH from Ing. Automotoristica (Turin), Mar. 1985 p 197-201 Presented at the 1st Inform. Seminar on Subproj. Road Transportation, Turin, 15-16 Nov. 1984 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

N86-13626# Joint Publications Research Service, Arlington, Va.
ITALIAN ROBOT MANUFACTURER ENTERS SPANISH MARKET
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-029) 30 Sep. 1985 p 38-41 Transl. into ENGLISH from Rev. Robotica (Barcelona), May - Jun. 1985 p 27-30 (For primary document see N86-13622 04-31)
Avail: NTIS HC A04/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-13749*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROBABILITY OF DETECTION OF INTERNAL VOIDS IN STRUCTURAL CERAMICS USING MICROFOCUS RADIOGRAPHY
George Y. Baaklini and Don J. Roth Nov. 1985 23 p refs
(NASA-TM-87164; E-2800; NAS 1.15:87164) Avail: NTIS HC A02/MF A01 CSCL 14D

The reliability of microfocus x-radiography for detecting subsurface voids in structural ceramic test specimens was statistically evaluated. The microfocus system was operated in the projection mode using low X-ray photon energies (<20 keV) and a 10 micro m focal spot. The statistics were developed for implanted subsurface voids in green and sintered silicon carbide and silicon nitride test specimens. These statistics were compared with previously-obtained statistics for implanted surface voids in similar specimens. Problems associated with void implantation are discussed. Statistical results are given as probability-of-detection curves at a 95 percent confidence level for voids ranging in size from 20 to 528 micro m in diameter. Author

N86-13750# California Univ., Los Angeles. Dept. of Materials Science and Engineering.
HIGH FREQUENCY QUANTITATIVE ANALYSIS OF MAGNETO-MECHANICAL ACOUSTIC EMISSION Final Report, 15 Jun. 1981 - 14 Mar. 1985
K. Ono Jun. 1985 5 p
(Contract DAAG29-81-K-0116)
(AD-A158222; ARO-18220.8-MS) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report summarizes the results of a research project for development of nondestructive evaluation methods for residual stresses. A method using computerized pattern recognition analysis can successfully estimate the level of residual stress, as well as microstructural changes of ferrous materials and components. GRA

N86-13751# Naval Ocean Systems Center, San Diego, Calif.
ENVIRONMENTAL STRESS SCREENING (ESS) Final Report, Oct. 1983 - Oct. 1984
C. C. Reader Jan. 1985 315 p
(AD-A158262; NOSC/TD-804) Avail: NTIS HC A14/MF A01 CSCL 13/8

The ESS is a technique of testing used for minimizing/eliminating hardware production-line workmanship errors. The application of vibration and temperature environments to items requiring screening can minimize/eliminate such errors as loose wires or parts, cold solder joints, loose screws or nuts, plus other assembly or fabrication type deficiencies. The ESS is applied at all stages of fabrication or assembly. The Naval Sea Systems requested that the commercial equipment used on the Precise Integrated Navigation System (PINS) be surveyed for compliance with NAVSEANOTE 3900 and NAVMAT P-9492. This investigation sought to determine the extent to which the PINS commercial equipment manufacturers apply ESS to their equipment during the manufacturing process and to compare commercial practices with Navy requirements in order to discover and document the differences. This report concludes that the limited investigation conducted does not provide a definitive basis for decision. Several alternatives for screening programs are discussed. GRA

N86-13752# Southwest Research Inst., San Antonio, Tex.
EXPLORATORY DEVELOPMENT ON ADVANCED EDDY CURRENT COIL EXCITATION AND SIGNAL PROCESSING Final Report, 9 Jan. 1981 - 9 Jan. 1984
J. L. Fisher, R. E. Beissner, and J. E. Doherty Apr. 1985 106 p
(Contract F33615-81-C-5036)
(AD-A159228; AFWAL-TR-85-4025) Avail: NTIS HC A06/MF A01 CSCL 14/2

The purpose of this program was to achieve improvements in eddy current performance by analytical and experimental exploratory development of the pulse mode of coil excitation as a means of evaluating surface and near-surface defects in low-conductivity materials used in gas turbine engine components. The program successfully demonstrated that the pulsed eddy current approach is capable of detecting flaws as small as 0.010 inch by 0.005 inch in a Ti-6-4 surface. In addition results indicate that this approach offers a promising way to estimate the depth of surface-breaking flaws. GRA

N86-13753# Sandia National Labs., Albuquerque, N. Mex.
TAPE JOINT DESIGN FOR A VIBRATION TABLE
R. P. Rechard and R. L. Mayes Jul. 1985 51 p
(Contract DE-AC04-76DP-00789)
(DE85-012617; SAND-84-1159) Avail: NTIS HC A04/MF A01

A proposal is made to connect the vibration shaker to its companion horizontal slip table with a large tape joint. An improved connection is needed to reduce the tie taken to switch the shaker from the vertical to the horizontal position and to transmit greater vibration to components bolted to the slip table. The distinct advantages of the tape joint are: self alignment, low mass, and joint stiffness; are important for the connection. For this tape joint design, the joint upset was eliminated; thus the standard design procedure was modified somewhat. To check the feasibility of reaching a 100 kip (445-kN) preload in a 15 in. (38-cm) section, a prototype joint is built. The static and dynamic tests verify the possibility of reaching the high preload. Furthermore, the tests indicate a small hydraulic jack is the best way to insert and remove the tapes. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-13754# Aeronautical Research Labs., Melbourne (Australia).
A NUMERICAL INVESTIGATION INTO THE PLASTIC STRESS AND STRAIN FIELDS AROUND A SURFACE CRACK
R. Jones, M. Heller, and J. T. Barnby (Aston Univ.) 1985 17 p refs
(ARL/Struc-R-414; AR-003-990) Avail: NTIS HC A02/MF A01

In recent years a great deal of work has been undertaken in order to characterize the elastic and plastic stress strain fields around a crack which is either in plane strain or plane stress. A number of criteria for assessing severity has been proposed; of these the J integral approach and the strain energy density factor (i.e., S) approach are widely used and it has been shown that S and J are linearly proportional. A methodology for three dimensional elastic-plastic finite element is developed, and the validity of the functional form of the two dimension solution for a three dimensional crack is investigated. Author

N86-13755*# Case Western Reserve Univ., Cleveland, Ohio.
TIME DEPENDENCY OF STRAINRANGE PARTITIONING LIFE RELATIONSHIPS Final Report
Sreeramesh Kalluri and S. S. Manson Aug. 1984 64 p refs
(Grant NAG3-337)
(NASA-CR-174946; NAS 1.26:174946) Avail: NTIS HC A04/MF A01 CSCL 20K

The effect of exposure time (or creep rate) on the CP life relationship is established by conducting isothermal CP tests at varying exposure times on 316 Ss at 1300 and 1500 F. A reduction in the CP cycle life is observed with an increase in the exposure time of the CP test at a given inelastic strain-range. This phenomenon is characterized by modifying the Manson-Coffin type of CP relationship. Two new life relationships: (1) the Steady State Creep Rate (SSRC) Modified CP life relationship, and (2) the Failure Time (FT) Modified CP life relationship, are developed in this report. They account for the effect of creep rate and exposure time within the CP type of waveform. The reduction in CP cyclic life in the long exposure time tests is attributed to oxidation and the precipitation of carbides along the grain boundaries. Author

N86-13756# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
CRUSHING STRENGTH OF ALUMINUM OXIDE AGGLOMERATES Final Report, Apr. 1983 - Sep. 1984
R. A. Gamble Jul. 1985 40 p Prepared in cooperation with Sverdrup Technology, Inc., Arnold AFS, TN
(AD-A158051; AEDC-TR-85-16) Avail: NTIS HC A03/MF A01 CSCL 20/11

Aluminum oxide, which is formed during combustion of aluminum-based solid propellants, condenses and solidifies in the exhaust flow to form sub-micron-size particles, which may then adhere together to form agglomerates. Particle sampling, which is required for motor performance or environmental impact investigations, is usually done using a probe placed in the supersonic exhaust flow field. The bow shock at the sample probe inlet will decelerate the gas flow which introduces a large velocity differential between the gas and particulate. This differential will result in a sudden increase on the aerodynamic drag on the agglomerates which may cause them to shear apart, thus altering the sample size distribution. In this effort, aluminum oxide agglomerates were formed and then crushed in order to estimate the magnitude of the interparticle forces binding the agglomerate together. The agglomerates were formed by tumbling commercially available aluminum oxide powder in a container, and strength was determined by measuring the load required to crush the agglomerate between two flat plates. Analysis indicated that through, uniformly-shaped particles formed the strongest agglomerates. The experimentally-

derived particle bonding forces were in agreement with values predicted by the van der Waal force equation for closely-spaced spheres. Rocket exhaust particulates collected from a test facility exhaust processing system proved to be unstable because of impurities. GRA

N86-13757# Wisconsin Univ., Madison. Mathematics Research Center.
A FUNCTIONAL EQUATION GOVERNING MOVING PHASE BOUNDARIES IN AN ELASTIC BAR Technical Summary Report
T. J. Pence Jun. 1985 40 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-82-10950)
(AD-A158178; MRC-TSR-2827) Avail: NTIS HC A03/MF A01 CSCL 20/11

Certain elastic solids when subjected to sufficiently high loads abruptly change their mechanical properties and yet continue to respond elastically to further loading. In one dimension such mechanically induced elastic phase transitions may be due to a non-monotonic stress-strain curve. This document investigates the cumulative reflection of acoustic waves between the external boundary of the solid and the internal moving boundary separating distinct elastic phases. This latter phase boundary is similar to a gas dynamical shock wave. For the material introduced in this work, a functional equation governing the trajectory of a phase boundary is derived and shown to have a unique solution. This equation is treated asymptotically to determine the large time behavior of the phase boundary. Author (GRA)

N86-13758# Wisconsin Univ., Madison. Mathematics Research Center.
DEVELOPMENT OF SINGULARITIES IN NONLINEAR VISCOELASTICITY Technical Summary Report
J. A. Nohel and M. Renardy May 1985 17 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-82-15064)
(AD-A158190; MRC-TSR-2821) Avail: NTIS HC A02/MF A01 CSCL 20/11

This paper discusses the motion of nonlinear viscoelastic materials with fading memory in one space dimension. It concentrates on viscoelastic solids and briefly remarks on similar results for fluids. After formulating the mathematical problems, the authors survey results for global existence of classical solutions to the initial value problem, provided the initial data are sufficiently small. They then discuss in some detail the development of singularities in initially smooth solutions for large data. GRA

N86-13759# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
ERRORS DUE TO COUNTING STATISTICS IN THE TRIAXIAL STRAIN (STRESS) TENSOR DETERMINED BY DIFFRACTION Technical Report
P. J. Rudnik and J. B. Cohen 1 Jul. 1985 13 p
(Contract N00014-80-C-0116)
(AD-A158219; TR-18) Avail: NTIS HC A02/MF A01 CSCL 20/11

Knowledge of the errors in a diffraction measurement of residual strains and stresses is useful information, not only in its own right, but also because it permits automation of a measurement to an operator specified precision. There are three sources of these errors: (1) instrumental effects; (2) uncertainties in X-ray elastic constants; and (3) errors in the diffraction peak position related to counting statistics. In this paper the errors are derived for the diffraction measurement of the three dimensional stress and strain tensor due to counting statistics. GRA

N86-13760# Army Materials and Mechanics Research Center, Watertown, Mass.
STATIC FATIGUE OF A SINTERED SILICON NITRIDE Final Report
G. D. Quinn Oct. 1984 16 p
(Contract DE-AI01-77CS51017)
(AD-A158813; AMMRC-TR-84-40) Avail: NTIS HC A02/MF A01 CSCL 11/2

The static fatigue resistance of a sintered silicon nitride was assessed at elevated temperature in air. The material was developed for heat engine applications. No difference in ambient or elevated temperature behavior was noted for the injection-molded or slip-cast versions. The material can maintain 150 MPa flexural stress for up to 1000 hours at 1200 C but is susceptible to slow crack growth and creep phenomena at higher stresses. Author (GRA)

N86-13761# Argonne National Lab., Ill.
SIMULATING DISTRIBUTED REINFORCEMENT EFFECTS IN CONCRETE ANALYSIS
A. H. Marchertas 1985 9 p refs Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-009745; CONF-850809-51) Avail: NTIS HC A02/MF A01

The effect of the bond slip is brought into the TEMP-STRESS finite element code by relaxing the equal strain condition between concrete and reinforcement. This is done for the elements adjacent to the element which is cracked. A parabolic differential strain variation is assumed along the reinforcement from the crack, which is taken to be at the centroid of the cracked element, to the point where perfect bonding exists. This strain relationship is used to increase the strain of the reinforcement in the as yet uncracked elements located adjacent to a crack. By the same token the corresponding concrete strain is decreased. This estimate is made assuming preservation of strain energy in the element. The effectiveness of the model is shown by examples. Comparison of analytical results is made with structural test data. The influence of the bonding model on cracking is portrayed pictorially. DOE

N86-13762# Argonne National Lab., Ill.
LONG-TERM ANALYSIS OF SLENDER CONCRETE STRUCTURES WITH CRACKING
J. C. Chern and A. H. Marchertas 1985 13 p Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-010275; CONF-850809-46) Avail: NTIS HC A02/MF A01

A special form of the finite element program, which is based on the equilibrium of forces in various cross sections of the beam together with the principle of virtual work, is presented for solving concrete beam problems. This analytical method uses the newly developed rheological element and exponential algorithm for computing time dependent deformation and stress distribution in cracked concrete members subjected to sustained loads, temperature, or drying. Temperature and moisture effects on hydration (aging) and creep rate are included. The rate effects of temperature and moisture on the deformation of concrete are also taken into account in the formulation. Numerical examples are used to illustrate the validity of the analysis on concrete beams. Plain and reinforced concrete beams subjected to bending, heating or drying are analyzed and checked against experimental data. DOE

N86-13763# Engineering System International, Rungis (France).
EMPLOYMENT OF PAM-FISS-BI-PHASE COMPUTER PROGRAM FOR THE STRENGTH ANALYSIS AND FRACTURE/DELAMINATION BEHAVIOR OF COMPONENTS Final Report
E. Haug, P. Dowlatyari, and A. deRouvray Paris ESA Jan. 1985 97 p
(Contract ESTEC-5489/83/NL-PB(SC))
(ESI-ED/83-383/RD/MS-Vol-7; ESA-CR(P)-2057) Avail: NTIS HC A05/MF A01

Numerical static tensile strength analysis and fracture behavior evaluation of a T300/914C carbon-epoxy (CE) composite material are summarized. Matrix (epoxy) macrocrack phenomena such as matrix splitting, matrix delamination and sublaminate matrix crack growth in process zones around notch roots were investigated using two and three-dimensional finite element models (with the PAM-FISS/BI-phase code), and compared to experimental results. For numerical analyses of unidirectional and multilayered

notched/unnotched CE tensile specimens, a universal toughness criterion for matrix cracking under tensile static loading is proposed : GI = mode I strain energy release, calibrated at GIc = 0.15 N/mm for the T300 epoxy matrix used. Author (ESA)

N86-13491# Joint Publications Research Service, Arlington, Va.
DETERMINING LOCAL HEATING PARAMETERS FOR INCREASING FATIGUE RESISTANCE OF WELDED JOINTS Abstract Only
V. N. Maksimovich, A. A. Chabanenko, P. P. Mikheyev, O. I. Gushcha, and Yu. F. Kudryavtsev *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 65-66 Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 4, Apr. 1985 p 32-36 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13589*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LARGE MODAL SURVEY TESTING USING THE IBRAHIM TIME DOMAIN IDENTIFICATION TECHNIQUE Final Report
Samir R. Ibrahim (Old Dominion Univ.) and Richard S. Pappa *In* Old Dominion Univ. Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 459-465 refs Presented at the AIAA/ASME/ASCE/AHS 22nd Struct., Struct. Dyn. and Mater. Conf., Atlanta, 6-8-1981 Previously announced in IAA as A81-29449 (For primary document see N86-13587 04-31)
(AIAA-81-0528R) Avail: NTIS HC A04/MF A01 CSCL 13B

N86-13591*# Old Dominion Univ., Norfolk, Va.
DYNAMIC MODELING OF STRUCTURES FROM MEASURED COMPLEX MODES Final Report
Samir R. Ibrahim *In its* Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 898-901 refs Previously announced in IAA as A82-30186 and A83-32988 (For primary document see N86-13587 04-31)
Avail: NTIS HC A04/MF A01 CSCL 13B

42 GEOSCIENCES (GENERAL)

N86-13764# International Geophysical Year World Data Center A, Boulder, Colo.
MARGINAL ICE ZONE BIBLIOGRAPHY
A. M. Brennan Jun. 1985 101 p
(AD-A159060; GD-17) Avail: NTIS HC A06/MF A01 CSCL 08/12

The issue provides a major bibliography on sea ice, meteorology and oceanography in the marginal ice zone. The topics discussed are: sea ice morphology and characteristics - W. J. Stringer; marginal ice zone bibliography: introduction, subject listing, author listing; note. GRA

N86-13765# Joint Publications Research Service, Arlington, Va.
USSR REPORT: EARTH SCIENCES Abstracts Only
13 Nov. 1985 53 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-85-009) Avail: NTIS HC A04/MF A01

Various topics relating to meteorology, oceanography, terrestrial geophysics, atmospheric physics, and arctic and antarctic research are discussed. Cloud seeding, air-water interactions, the ocean bottom, rotating spheres, acousto-optics, and laser applications are explored. For individual titles, see N86-13766 through N86-13793.

N86-13766# Joint Publications Research Service, Arlington, Va.
GOSKOMGIDROMET PLANS AUTOMATION OF AERIAL CLOUD-SEEDING WORK Abstract Only **c47**
Vera Dorofeyeva and Vil Dorofeyev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 2 Transl. into ENGLISH from Literaturnaya Gazeta (Moscow), 26 Jun. 1985 p 11 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The development and testing of an original computerized complex for cloud-seeding work aimed at inducing rainfall are discussed. During flights on airplanes equipped with this complex, cloud zones that are optimal for seeding are detected with the aid of suitable apparatus and a computer, which issues the necessary recommendations for the crew. The testing of the complex is scheduled for completion this year. Work is to begin this year on inducing additional rainfall over 500,000 hectares of steppe lands in the Ukraine and over areas of 300,000 hectares in Georgia and 100,000 hectares in Uzbekistan. The protection of agricultural crops against hail is called the main direction of the administration's weather-modification work. An account is given of a flight in which hail-bearing clouds were seeded by means of rockets fired from a radar-equipped airplane. The equipping of such airplanes with computerized units for processing multiple-contour radar representations (BOMO) reportedly is planned at an early date. In a radar-computer-BOMO-rocket system of the future, the operation of the radar set will be automated, and rockets will be fired from the airplane on a command from the computer. R.J.F.

N86-13767# Joint Publications Research Service, Arlington, Va.
MODEL INTERPRETATION OF ANNUAL VARIATION OF TEMPERATURE FIELDS OF AIR AND WATER BOUNDARY LAYERS OF WORLD OCEAN Abstract Only **c46**
A. Ye. Rozhdestvenskiy and M. V. Semenov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 8 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 537-543 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Heat exchange between the ocean and atmosphere is largely determined by the temperatures of the boundary layers of these media, especially the annual variation of temperature of the ocean T sub w and atmosphere T sub a. A study was made of the behavior of the phase difference delta phi over the entire area of the world ocean, other than the polar regions, from 60 N to 60 S. The delta phi value was obtained for each 10 deg grid square using the mean T sub w and T sub a climatic values. Over almost the entire world ocean, the temperature of the near-water atmospheric layer in its annual variation outruns ocean surface temperature (delta phi >). The average shift for the entire ocean is 7 days (Atlantic - 8, Indian - 9 and Pacific - 5 days). A table gives the delta phi values in days averaged for 10 deg latitude zones for each of the oceans and the world ocean in a while and the standard deviations from the mean values. The temperature latitudes of the Northern Hemisphere are most uniform with respect to delta phi; the maximum phase shifts are observed there, but there are individual regions in both the tropical zone and in the Antarctic Ocean with extreme delta phi values. In comparison with the Northern Hemisphere temperate latitudes the tropical latitudes and the Antarctic Ocean have a more complex structure of delta phi distribution. The annual variation of temperatures can be explained in a model of thermal interaction between the boundary layers of the ocean and atmosphere. R.J.F.

N86-13768# Joint Publications Research Service, Arlington, Va.
FORMATION OF STRUCTURE OF MIXED REGION UNDER INFLUENCE OF SHEAR FLOW IN STRATIFIED FLUID Abstract Only **c34**
L. A. Dykhno *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 9 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 528-536 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The forms of shear instability accompanying the formation of the mixed region are discussed. A number of processes transpiring in the ocean under the influence of the developing and stationary wind are explained. The rectangular flume measured 80 x 16 x 20 cm. Air was fed for creating a velocity shear in the water in a wind channel formed by the flume cover and the free surface of the water. The initial stratification was formed as a result of heat exchange between the cold water and warm air. A stable tempera-

ture profile was established in the water with a gradient increasing toward the surface. The initial stratification was evaluated using the temperature gradient in the layer, which was varied from 0.12 to 0.3 C/cm. The following measurements were made: air flow velocity, water low velocity and vertical temperature profile. A laser knife was used in visual observations. A study was made of the main stages in formation of the mixed region. The mechanism of entrainment of fluid by large-scale eddies was explored in depth. This research made it possible to find the dependence of the entrainment rate on the Richardson number. R.J.F.

N86-13769# Joint Publications Research Service, Arlington, Va.
COMPUTATION OF OCEAN UPPER LAYER THERMAL STRUCTURE Abstract Only **c48**
A. Yu. Benilov, N. G. Kozhelupova, and B. N. Filyushkin *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 10 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 378-385 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Specialists at the Oceanology Institute developed a mathematical model which on the basis of meteorological data makes it possible to predict the temperature of the upper quasihomogeneous layer (UQL), its thickness, drift current velocity characteristics of vertical structure of the temperature field in the upper layer of the ocean governed by heating of the ocean from the surface and the convection arising during cooling. This integral model is intended for prediction of UQL short-period changes occurring against the background of seasonal changes. Storm effects during which there can be considerable increases in UQL thickness and formation of a stepped structure of temperature change with depth are superposed on these mean seasonal changes. The work was done in the North Atlantic during the period of spring to summer heating and summer. A value obtained in the case of well-developed wind waves was used as the sea surface resistance coefficient. It was found that the integral model makes it possible to compute change in thickness of the UQL and its temperature for 3 to 4 days in advance with an accuracy acceptable for practical using initial data and current wind velocity and heat flow values at a point. R.J.F.

N86-13770# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF CHARACTERISTICS OF SYNOPTIC MOVEMENTS ON SPHERE Abstract Only **c47**
A. D. Marushkevich *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 11 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 386-394 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Several numerical experiments were carried out for simulation of movements of a synoptic scale on a sphere. The main objective was clarification of the characteristics of movements of a synotpic scale associated with the Earth's sphericity (in comparison with the beta-plane). The computation region was in the form of a segment of a spherical surface bounded on the north and south by arcs of latitude and on the west and east by meridians. In modeling synoptic eddies consideration was given only the barotropic mode of movements (a vertical uniformity of currents was assumed). The initial equations used were the equations of motion in spherical coordinates in the Boussinesq approximation and in the traditional approximation. Two variants of the model were tested: in spherical coordinates and Cartesian (beta-plane approximation) coordinates. It was concluded that in studies of synoptic movements in the open ocean in regions with a great longitudinal extent (some ten degrees) it is necessary that the Earth's sphericity be taken into account since the use of the beta-plane approximation in this case gives results differing somewhat in qualitative and quantitative respects. R.J.F.

N86-13771# Joint Publications Research Service, Arlington, Va.
VERTICAL STRUCTURE OF TURBULENCE AND TURBULENT EXCHANGE IN EQUATORIAL ZONE OF PACIFIC OCEAN Abstract Only **c48**
A. N. Gezentsvey *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 12-13 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 414-419 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The experimental study of intermittence, the determination of the laws of distribution of the sizes of turbulent zones and the coefficients of vertical turbulent exchange in intermittent turbulent fields are extremely timely because without a knowledge of the laws of these phenomena it is impossible to give an adequate description of the vertical redistribution of heat, salt and momentum in the ocean. On the 24th cruise of the Dmitrity Mendeleyev complex hydrophysical measurements were made in the equatorial system of currents in a broad range of spatial-temporal scales. Fluctuations of the current velocity field were measured by the Baklan freely falling probe. Fluctuation measurements were accompanied by registry of depth and mean water temperature. Measurements of velocity fluctuations were made using a sensor of the magnetohydrodynamic type, insensitive to the influence of medium stratification, with a linear characteristic and an instrument noise level approx. 0.07 cm/sec. Measurements were made in the frequency range 4 to 64 Hz with a mean rate of submergence of the probe of 1 m/sec, making it possible to register turbulence in the range of vertical scales from 2 to 25 cm. Author

N86-13772# Joint Publications Research Service, Arlington, Va.
SOME CHARACTERISTICS OF BOTTOM DENSITY CURRENTS Abstract Only **c48**
V. N. Anuchin, V. M. Belokopytov, and V. A. Gritsenko *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 13-14 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 420-424 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Bottom density currents have a number of interesting properties, the most important of which is the propagation of these flows over very great distances without a significant change in their thickness. The authors investigated the plane flow of a denser fluid in a less dense fluid along a sloping bottom, thereby modeling the shelf zone and the continental slope. Salinity stratification is assumed. On the basis of a general system of equations of thermohydrodynamics a system of equations is derived for describing movement of the bottom flow. An analysis of the corresponding laminar flow gave distributions functionally similar to those observed experimentally and a complete inadequate lifetime of the bottom flow, indicating a turbulent nature of the flow of a bottom density current, with a clearly expressed anisotropy of turbulence. Vertical profiles of current velocity and density were obtained for different moments in time, as well as the distributions of turbulent stress obtained as a result of numerical solution. Experimental and computed data are compared. The negative value of turbulent stress at the upper boundary of the flow is apparently one of the main reasons for the great lifetime of bottom density flows. The analysis of the existence and dynamics of bottom density currents indicates that the described model, within the framework of the initial assumptions, makes it possible to describe the internal structure of bottom flows. Author

N86-13773# Joint Publications Research Service, Arlington, Va.
HIGHLY DISPERSE MINERALS IN SEDIMENTS IN NEIGHBORHOOD OF EAST PACIFIC OCEAN RISE DETERMINED FROM DRILLING DATA Abstract Only **c48**
Z. N. Gorbunova *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 14-15 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 465-470 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Extensive materials were collected on the 8th and 14th cruises of the Dmitriy Mendeleyev and the 24th cruise of the Akademik Kurchatov which make it possible to carry out a detailed study of the composition of highly disperse minerals in the region of the East Pacific Ocean Rise. Three boreholes were studied in the neighborhood of the rise. All penetrated through the sedimentary

stratum down to the basalt. These materials can be used in studying the lateral change in the composition of highly disperse minerals and also vertically over the extent of formation of the entire sedimentary stratum lying on the basalts of the oceanic crust. The principal research methods were X-ray - diffractometric and electron microscopic. The distribution of highly disperse minerals in boreholes reflects the tectonic history of the ocean. In the samples of metal-bearing sediments above the basalt there is a predominance of minerals formed under the influence of endogenous sources. With increasing distance from the spreading axis their role decreased, with the endogenous minerals being replaced by a terrigenous-volcanic complex. R.J.F.

N86-13774# Joint Publications Research Service, Arlington, Va.
STUDY OF OPTICAL-ACOUSTICAL PHENOMENA AT SURFACE OF STRONGLY ABSORBING CLEARING FLUIDS Abstract Only **c36**
F. V. Bunkin, K. L. Vodopyanov, L. A. Kulevskiy, G. A. Lyakhov, V. G. Mikhalevich, and A. M. Rodin *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 18 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 558-563 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The clearing of water by laser radiation with a wavelength lambda = 2.94 microns was reported by K. L. Vodop'aynov, et al., (ZhETF, Vol. 82, p 1820, 1982). For further clarification of this problem, the authors studied optical-acoustic phenomena at the surface of a fluid under conditions of strong absorption and optical clearing with emphasis on detection of the characteristics of the thermal and evaporation regimes of generation of acoustic fields by laser radiation. Studies were made of different fluids containing hydroxyl groups (water, ethanol, glycerin, ethylene glycol) with different boundary conditions (free and fixed boundaries). In the case of a free boundary, the laser radiation was directed downward along the normal to the fluid surface, but in the case of a rigid boundary the fluid surface was covered by a backing of transparent material. Experimental results are presented. At the present time there is no certain interpretation of the observed effects. However, it is known that the presence of hydrogen bonds in fluids containing the OH group leads to a strong shift into the region of lesser frequencies of the absorption band. Partial breaking of the hydrogen bonds under the influence of laser radiation can result in a change in the absorption spectrum of the fluid and accordingly a clearing at the laser wavelength. Author

N86-13775*# Joint Publications Research Service, Arlington, Va.
AERIAL LASER SENSING OF OCEAN UPPER LAYER Abstract Only
D. V. Vlasov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 19 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 433-441 (For primary document see N86-13765 04-43)
Avail: NTIS HC A04/MF A01

Applications of laser sensing of the ocean, such as deep bathymetry; determination of the luminescence spectrum of phytoplankton as a sensitive indicator of changes in the external physical parameters of the studied region; monitoring the state of underwater pipelines; conducting search and rescue missions; monitoring pollution; biological observations of the state of algae; searching for schools of fish, etc., are discussed. The Chayka apparatus for laser sensing is discussed. A block diagram is given which is used in describing functioning of this unit. Particular attention is given to the time structure of an echo signal appearing when sensing the upper ocean layer by a short laser pulse propagating through the wave-covered surface. R.J.F.

N86-13776# Joint Publications Research Service, Arlington, Va.
FORMATION OF UNDERWATER OCEANIC VOLCANOES AND ISLANDS IN RELATION TO LITHOSPHERIC THICKNESS AND MOVEMENTS Abstract Only **c46**
A. M. Gorodnitskiy *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 20 Transl. into ENGLISH from Byul. Mosk. Obshchestva Ispytateley Prirody: Otd. Geol. (Moscow), v. 60, no. 4, Jul. - Aug. 1985 p 24-37 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

A brief review of geological and geophysical data on oceanic volcanoes, relating their formation to the thickness and nature of movements of the lithosphere, is presented. Analysis of the height and composition of such paleovolcanoes and various island chains demonstrated that such characteristics are predicated on the pT factors of magma formation under the lithosphere. The origins of such mountains are determined by plate stresses due to tectonic forces acting at plate boundaries, membrane effects and changes in the thermal regimes of the lithosphere leading to a system of rifts. Author

N86-13777# Joint Publications Research Service, Arlington, Va.
VOLCANOES DISCOVERED WITH RADIO BEAM Abstract Only
In its USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 21 Transl. into ENGLISH from Tass (Moscow), 16 May 1985 (For primary document see N86-13765 04-43)
Avail: NTIS HC A04/MF A01

Two giant volcanoes were discovered by Soviety scientists. One of them lies beneath the hot sands of West Sahara and the other under the Antarctic ice in the area of James Ellsworth Land. The craters were spotted with the help of a radio location system installed abroad the Soviet satellites Cosmos-1500 and Cosmos-1602. The system was developed at the Kharkov Institute of Radio Physics and Electronics, the Academy of Science of the Ukraine. The radioeye, with its scanning range of about five hundred kilometers, is able to spot objects less than a kilometer in size. The system, operating automatically, collects, selects and codes data and transmits it back to Earth in ready-to-use form. In the opinion of specialists, the use of Kharkov-made radio locators in orbit has started a new line in the exploration of the Earth's surface and the world ocean. This system has no analogues anywhere in the world for the breadth of scanning and possibilities it offers for immediately sending information, through stationary communications channels, directly to users. R.J.F.

N86-13778# Joint Publications Research Service, Arlington, Va.
COMPUTER-AIDED AERIAL RADIOMETRIC SURVEYING OF SOIL MOISTURE Abstract Only
N. Armand *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 24 Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 30 Jun. 1985 p 2 (For primary document see N86-13765 04-43)
Avail: NTIS HC A04/MF A01

A new method and an apparatus which were developed for aerial radiometric surveying to determine soil moisture content are discussed. The method employs an airborne radiometer operating in tandem with an onboard computer, which converts signals into moisture-content figures. Magnetic recordings of the data are fed into a ground computer which contains information on features of the locality where the survey was made. It is reported that the new apparatus passed field tests in a number of areas. It can be used for other environmental monitoring purposes, such as determining the content of minerals, acids, salts and alkalis in surface water and detecting changes in electrophysical properties of water. Author

N86-13779# Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF BRIGHTNESS FROM POINT SOURCE OF SCATTERED LIGHT ALONG INCLINED PATH Abstract Only **c74**
A. S. Drofa and A. L. Usachev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 28 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 6, Jun. 1985 p 603-608 Original language document was announced in IAA as A85-44481 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The angular distribution of light scattered from a point source

by a cloud layer along an inclined line of sight has been calculated using the Monte Carlo method. The relation of the brightness and asymmetry of the light to cloud layer parameters along the line of sight is examined. It is shown that the asymmetry of the light may be both positive and negative in value depending on cloud layer parameters. In the case of an inclination angle of less than about 80 degrees, displacement of the brightness distribution above and below the line of sight was found. The intensity of scattered light was different in the case of a vertical line of sight when cloud layer parameters were the same as in the inclined case. I.H. (IAA)

N86-13780# Joint Publications Research Service, Arlington, Va.
STATISTICAL CORRELATION BETWEEN OZONE LEVELS OVER ATLANTIC OCEAN AND METEOROLOGICAL VALUES Abstract Only c46
V. M. Bazhanov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 29 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 6, Jun. 1985 p 609-613 Original language document was announced in IAA as A85-44482 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The latitudinal distribution of the total amount of ozone in various atmospheric layers was derived from data obtained on board a scientific vessel in the Atlantic Ocean in the period Feburary to June, 1980. The total amount of ozone is given in relation to variations in tropopause height and temperature. The distinctive features of ozone distribution in the Tropical Convergence Zone are discussed. The spectrum of variations in aerosol particle size was correlated with the meteorological parameters of the surface boundary layer. Empirical regression equations are formulated to describe the statistical connection between the total amount of ozone the surface boundary-ration of radioactive tracers in layer. I.H. (IAA)

N86-13781# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF FOG MICROSTRUCTURE ON QUALITY OF OPTICAL IMAGE TRANSMITTED THROUGH IT Abstract Only c74
L. P. Volnistova, A. S. Drofa, and V. P. Snykov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 29-30 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 6, Jun. 1985 p 507-511 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Data on the optical transfer function (OTF) of fogs with different microstructures are presented. The OTF of a fog artificially formed in the chamber was determined experimentally by measurement of the brightness profile of the image of a narrow self-luminescent line observable through a fog. The brightness of the line image was measured with a photomultiplier situated behind the focus of a receiving objective. Fog transparency and its microstructure were measured during the experiments. It is found that after fog formation the microstructure is transformed, caused by droplet evaporation due to heat release from the chamber walls and due to droplet precipitation onto the floor and walls. The time required for total disappearance of the fog was 40 to 60 minutes. The experimental data agreed well with the computations. Author

N86-13782# Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN MEASURING MEAN WIND VELOCITY PROFILE IN LOWER TROPOSPHERE BY SODAR ANEMOMETER UNDER INVERSION AND CONVECTIVE CONDITIONS Abstract Only c47
M. A. Kallistratova, Y. Keder, I. V. Petenko, and N. S. Time *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 30-31 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 492-497 Original language document was announced in IAA as A85-40641 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Specialists at the Atmospheric Physics Institute have developed a solar anemometers for measuring the horizontal component of wind velocity. It is a slant monostatic sodar for measuring the Doppler shift of the frequency of sound reflected from moving air density inhomogeneities. The wind velocity profile was measured on a mast to a height of 32 m with cup anemometers; the mast was at a distance of 40 m from the sodar anemometer. Also employed was a vertical sonar which registered echo signal intensity on a facsimile apparatus which provides data on the spatial-temporal distribution of temperature fluctuations C sub t sq. The type of atmospheric stratification is determined from the form of the facsimile records. The combined measurements provided data on the behavior of the wind velocity profile under convective and inversion conditions. E.A.K.

N86-13783# Joint Publications Research Service, Arlington, Va.
STRUCTURAL CHARACTERISTIC OF TEMPERATURE FIELD OVER SEA Abstract Only c47
B. M. Koprov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 31-32 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 485-491 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The structural function of the temperature field is described. Measurements in the surface atmospheric layer yielded universal expressions relating C sub t sq and atmospheric surface characteristics. In the surface layer the fields of wind velocity, temperature and humidity have specific characteristics not typical of wind the near-ground layer. Density stratification and the generation of kinetic energy by buoyancy forces are determined to an equal degree by the distribution of temperature and humidity. Temperature, wind velocity and humidity were measured aboard ship at a height of about 10 m and water temperature near the surface. Regular measurements of the structural characteristic and meteorological parameters were made in the Baltic Sea, North Sea, Mediterranean Sea, Red Sea and Indian Ocean. Sensors were 14 m above water level. Among the instruments used was a special difference-type resistance microthermometer (described in some detail, with a block diagram). The correlation between the structural characteristic of temperature and parameters determined from standard meteorological observations is examined. E.A.K.

N86-13784# Joint Publications Research Service, Arlington, Va.
ATMOSPHERIC SYNOPTIC EDDIES OVER OCEAN (DETERMINED FROM EXPERIMENTAL DATA) Abstract Only c46
V. Ye. Lagun and V. F. Romanov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 32 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 474-484 Original language document was announced in IAA as A85-40640 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Field data obtained during the POLEX North-79 experiment were used to study synoptic eddies (SEs) over the Norwegian Sea. Numerical calculations of the physical parameters of SEs show that rotation and movement of air masses in the surface layer, and wave-like perturbations in the upper layers. Partial mass transfer between layers was also found. The energy structure of SEs was studied in relation to their energy budget properties. It is concluded that atmospheric circulation over ocean regions is driven by two basic forces: the mean main flow and atmospheric synoptic eddies. The possible contribution of atmospheric eddies to the formation and localization of zones of active sea/air energy exchange is also discussed. I.H. (IAA)

N86-13785# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF PETROLEUM POLLUTION ON OCEAN-ATMOSPHERE GAS EXCHANGE INTENSITY (IN EXAMPLE OF NORTH ATLANTIC) Abstract Only c45
V. V. Alekseyev, P. A. Baranov, A. O. Kokorin, and V. M. Sheremetyev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 33 Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz., Astron. (Moscow), v. 26, no. 3, May - Jun. 1985 p 71-74 (For primary document see N86-13765 04-42)

Avail: NTIS HC A04/MF A01

The influence of petroleum pollution on gas exchange intensity was evaluated. Laboratory experiments determined gas transfer through the water-air interface with the presence of a hydrocarbon film on the surface under conditions of wind-wave mixing and during thermal convection. The CO2 concentration in water and in the air, CO2 fluxes at the water-air interface and values of the gas exchange rate coefficient were measured. Convection results in an intensification of gas exchange comparable to the influence of wind-wave mixing; a hydrocarbon film reduces the gas exchange rate caused by convection by approximately half. The experimental data were used to estimate the influence of petroleum pollutants on the intensity of gas exchange in the North Atlantic. A map of the probability of North Atlantic pollution is given. As a result of petroleum films there is an average decrease in the rate of gas exchange by 2 to 3%. E.A.K.

N86-13786# Joint Publications Research Service, Arlington, Va.
STATISTICS OF INTENSIVE LIGHT BEAMS IN TURBULENT ATMOSPHERE Abstract Only **c74**
V. P. Kandidov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 34 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 442-449 Original language document was announced in IAA as A85-31855 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The propagation of high-intensity laser beams in a turbulent atmosphere is investigated statistically for various radiation conditions. In particular, attention is given to the adaptive focusing of light beams under conditions of the combined effect of nonlinear refraction and inhomogeneities of the medium parameters. The analysis employs numerical methods in the approximation of the parabolic theory of diffraction. V.L. (IAA)

N86-13787# Joint Publications Research Service, Arlington, Va.
NEW METHODS FOR LASER SOUNDING OF ATMOSPHERE ON BASIS OF NONLINEAR EFFECTS Abstract Only **c46**
V. Ye. Zuyev and Yu. D. Kopytin *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 34-35 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 418-427 Original language document was announced in IAA as A85-31852 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Atmospheric sounding techniques based on nonlinear and coherent optical effects associated with the use of high-power lasers are reviewed with reference to three groups of methods. The first group includes lidar methods relying on optical, acoustic, and radio emissions during remote laser breakdown of the atmosphere as sources of information. The second group comprises methods of nonlinear and coherent Raman spectroscopy at vibrational-rotational transitions of gas molecules and resonant fluctuations of the shape of aerosol particles. The third group includes highly sensitive atmospheric sounding methods based on nonlinear intracavity effects during laser reception of echo signals. The discussion also covers problems related to the nonlinearity of lidar signals and applicability limits of linear equations of optical location in traditional sounding schemes employing high-power laser sources. V.L. (IAA)

N86-13788# Joint Publications Research Service, Arlington, Va.
INTERACTION BETWEEN POWERFUL LASER RADIATION AND ATMOSPHERIC AEROSOLS Abstract Only **c46**
M. P. Gordin, Yu. N. Grachev, V. S. Loskutov, V. P. Sadovnikov, A. V. Sokolov, and G. M. Strelkov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 35-36 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 450-458 Original language document was announced in IAA as A85-31856 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

Results of theoretical and experimental studies of the propagation of high-power laser beams in aqueous and soot aerosols under conditions of thermally induced beam distortions and aerosol brightening are reviewed. Topics discussed include the interaction of an individual particle and a polydisperse system of particles with a radiation field; changes in the transparency of aerosol layers due to radiation; and the propagation of laser beams through a turbid atmosphere. Most of the results presented here refer to the wavelength 10.6 microns. V.L. (IAA)

N86-13789# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF NONLINEAR SPECTROSCOPIC EFFECTS IN INTERACTION BETWEEN CO2-LASER RADIATION AND ATMOSPHERIC GASES Abstract Only **c46**
B. G. Ageyev, Ye. P. Gordov, Yu. N. Ponomarev, and S. D. Tvorogov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 36 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 459-465 Original language document was announced in IAA as A85-31857 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The paper is concerned with nonlinear nonresonance light absorption in the case where the frequency field corresponds to a relatively distant wing of the spectral band. The origin of this effect and its qualitative characteristics are investigated by extrapolating the accompanying physical conditions to the case of a strong field. Results of experiments are reported in which the absorptivity of H2O and D2O vapors has been studied as a function of pulsed CO2 laser emission at a wavelength of 10.6 microns. V.L. (IAA)

N86-13790# Joint Publications Research Service, Arlington, Va.
OBSERVATION OF OPTICAL-RADIO FREQUENCY RESONANCE IN H2O USING WIDE-BAND RUBY LASER SPECTROSCOPY Abstract Only **c32**
V. P. Kochanov, V. P. Lopasov, and S. F. Lukyanenko *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 37 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 516-520 Original language document was announced in IAA as A85-31864 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

An attempt is made to detect the effect of intra-Doppler Stark splitting produced by an intense radio frequency field on the absorption spectrum of probing optical emission under conditions of a complex resonance of the optical and radio frequency fields and the corresponding transitions. In the experiment described here, absorption in H2O at 694.38 nm is recorded by a wideband intracavity laser spectrometer based on a ruby laser. An analysis of experimental data indicates that the observed narrowing and widening of the trough in the generation spectrum characteristic are caused by a complex optical-radio resonance involving a resonant summation of the amplitudes of the probabilities of weak optical and resolved radio frequency transmition between the M-sublevels of Stark splitting. V.L. (IAA)

N86-13791# Joint Publications Research Service, Arlington, Va.
EFFECTIVENESS OF USE OF ADAPTIVE OPTICAL SYSTEMS UNDER CONDITIONS OF SELF-EFFECT IN ATMOSPHERE Abstract Only **c74**
P. A. Konyayev, V. P. Lukin, and V. L. Mironov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 38 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 536-540 Original language document was announced in IAA as A85-31867 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

A numerical simulation study of fast phase-conjugated adaptive system is carried out with the aim of evaluating their maximum efficiency with regard to the suppression of the thermal self-defocusing of laser beams. The system is fast in the sense that its response time is significantly less than the characteristic variation time of the temperature of the medium. It is shown that the system can increase the maximum intensity of radiation transmitted through the atmosphere by an order of magnitude. The presence of turbulent fluctuations of refractive index on the path enhances the correction efficiency of thermal distortions in the beam;

however, the phase-correlation scale at the emitting aperture decreases, which makes it necessary to increase the number of control elements of the adaptive mirror. B.J. (IAA)

N86-13792# Joint Publications Research Service, Arlington, Va.
LATITUDE MEASUREMENTS OF COSMIC RADIATION INTENSITY IN STRATOSPHERE AND AT SEA LEVEL ON MARINE ANTARCTIC EXPEDITIONS Abstract Only c93
Nikolay Savvich Svirzhevskiy *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 39 Transl. into ENGLISH from "Shirotnyye Izmereniya Intensivnosti Kosmicheskogo Izlucheniya v Stratosfere i na Urovne Morya v Morskikh Antarkticheskikh Ekspeditsiyakh" Moscow, 1983 p 1-16 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

The correlation coefficients (W9R,x, t) for the activity minimum 1975 to 1976 were determined on the basis of: stratospheric latitude measurement; measurement of the flux of soft charged radiation and gamma radiation at sea level as a function of cutoff rigidity Rc and determination of the latitude effect for the charged and gamma radiations; checking of the geomagnetic cutoff thresholds Rc, computed using the IGRF magnetic field model; clarification of the role of the radioactive background for determining the latitude effect for low-energy particles. The design of the instrument used in cosmic ray measurements at sea level the processing of measurement data are described the results of latitude measurements of ionizing and gamma radiations at sea level are presented, latitude stratospheric measurements at the solar activity minimum 1975 to 1976 are outlined. The sea-level latitude measurements gave the flux of charged cosmic radiation and the distribution of cosmic ray intensity as a function of Rc. Comparison of the measurements made in the Northern and Southern Hemispheres in the Atlantic reveals a systematic difference in the Rc values which requires introduction of a correction. E.A.K.

N86-13793# Joint Publications Research Service, Arlington, Va.
HADRON COMPONENT OF COSMIC RADIATION AT ATMOSPHERIC DEPTH 800 g/cm(2) IN ENERGY RANGE 70 TO 700 GeV Abstract Only c93
Petr Sergeyevich Vasilyev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 40 Transl. into ENGLISH from "Adronnaya Komponenta Kosmicheskogo Izlucheniya na Glubine Atmosfery 800 g/cm(2) v Oblasti Energiy (70-700GeV)" Moscow, 1984 p 1-20 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

A spark spectrometer was developed for registry of cosmic radiation hardons. The study of this instrument in the particle beams of the Serpukhovo accelerator made it possible to reduce the systematic errors in the measurement of cosmic radiation hardons to a minimum. Existing methods for studying the hadron component; the characteristics of interaction between pions and protons and spark spectrometer matter obtained using the Serpukhovo accelerator; the parameters of hadron showers in the spark spectrometer, used in studying hadron fluxes in cosmic rays; the ratios of fluxes of pions and protons, the absolute intensities of the flux of neutrons and the total hadron flux at an elevation of 2,000 m above sea level; and the measurement data are discussed. The integral intensities of fluxes of neutrons and hadrons in the energy range >240 GeV were determined. It is found that there is a systematic increase in the eta/P ratio of fluxes in the energy range 120 to 330 GeV. E.A.K.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-13794*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FUNDAMENTAL REMOTE SENSING SCIENCE RESEARCH PROGRAM: THE SCENE RADIATION AND ATMOSPHERIC EFFECTS CHARACTERIZATION PROJECT Summary Report, 1985
Donald W. Deering Sep. 1985 195 p refs Proc. of the 3rd Ann. SRAEC Principal Investigators Meeting, Cambridge, Mass., 29-31 Jan. 1985 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E86-10011; NASA-TM-86234; NAS 1.15:86234) Avail: NTIS HC A09/MF A01 CSCL 05B

The Scene Radiation and Atmospheric Effects Characterization (SRAEC) Project was established within the NASA Fundamental Remote Sensing Science Research Program to improve our understanding of the fundamental relationships of energy interactions between the sensor and the surface target, including the effect of the atmosphere. The current studies are generalized into the following five subject areas: optical scene modeling, Earth-space radiative transfer, electromagnetic properties of surface materials, microwave scene modeling, and scatterometry studies. This report has been prepared to provide a brief overview of the SRAEC Project history and objectives and to report on the scientific findings and project accomplishments made by the nineteen principal investigators since the project's initiation just over three years ago. This annual summary report derives from the most recent annual principal investigators meeting held January 29 to 31, 1985. For individual titles, see N86-13795 through N86-13812.

N86-13795*# Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
REFLECTANCE MODELING
James A. Smith, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 38-45 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

The overall goal of this work has been to develop a set of computational tools and media abstractions for the terrain bidirectional reflectance problem. The modeling of soil and vegetation surfaces has been emphasized with a gradual increase in the complexity of the media geometries treated. Pragmatic problems involved in the combined modeling of soil, vegetation, and atmospheric effects have been of interest and one of the objectives has been to describe the canopy reflectance problem in a classical radiative transfer sense permitting easier inclusion of our work by other workers in the radiative transfer field. Author

N86-13796*# Nebraska Univ., Lincoln.
BIDIRECTIONAL REFLECTANCE MODELING OF NON-HOMOGENEOUS PLANT CANOPIES
John M. Norman, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 46-53 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

The objective of this research is to develop a 3-dimensional radiative transfer model for predicting the bidirectional reflectance distribution function (BRDF) for heterogeneous vegetation canopies. The model (named BIGAR) considers the angular distribution of leaves, leaf area index, the location and size of individual subcanopies such as widely spaced rows or trees, spectral and directional properties of leaves, multiple scattering, solar position and sky condition, and characteristics of the soil. The model relates canopy biophysical attributes to down-looking radiation measurements for nadir and off-nadir viewing angles. Therefore, inversion of this model, which is difficult but practical should provide surface biophysical pattern; a fundamental goal of remote sensing. Such a model also will help to evaluate atmospheric limitations to satellite remote sensing by providing a good surface boundary condition for many different kinds of canopies.

Furthermore, this model can relate estimates of nadir reflectance, which is approximated by most satellites, to hemispherical reflectance, which is necessary in the energy budget of vegetated surfaces. Author

N86-13797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNDERSTANDING THE RADIANT SCATTERING BEHAVIOR OF VEGETATED SCENES
Daniel S. Kimes, Principal Investigator *In its* Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 54-59 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Knowledge of the physics of the scattering behavior of vegetation will ultimately serve the remote sensing and earth science community in many ways. For example, it will provide: (1) insight and guidance in developing new extraction techniques of canopy characteristics, (2) a basis for better interpretation of off-nadir satellite and aircraft data, (3) a basis for defining specifications of future earth observing sensor systems, and (4) a basis for defining important aspects of physical and biological processes of the plant system. The overall objective of the three-year study is to improve our fundamental understanding of the dynamics of directional scattering properties of vegetation canopies through analysis of field data and model simulation data. The specific objectives are to: (1) collect directional reflectance data covering the entire exitance hemisphere for several common vegetation canopies with various geometric structure (both homogeneous and row crop structures), (2) develop a scene radiation model with a general mathematical framework which will treat 3-D variability in heterogeneous scenes and account for 3-D radiant interactions within the scene, (3) conduct validations of the model on collected data sets, and (4) test and expand proposed physical scattering mechanisms involved in reflectance distribution dynamics by analyzing both field and modeling data. Author

N86-13798*# Purdue Univ., West Lafayette, Ind. Lab. for Applications of Remote Sensing.
MEASUREMENT AND MODELING OF THE OPTICAL SCATTERING PROPERTIES OF CROP CANOPIES
V. C. Vanderbilt, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 60-66 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 20F

The specular reflection process is shown to be a key aspect of radiation transfer by plant canopies. Polarization measurements are demonstrated as the tool for determining the specular and diffuse portions of the canopy radiance. The magnitude of the specular fraction of the reflectance is significant compared to the magnitude of the diffuse fraction. Therefore, it is necessary to consider specularly reflected light in developing and evaluating light-canopy interaction models for wheat canopies. Models which assume leaves are diffuse reflectors correctly predict only the diffuse fraction of the canopy reflectance factor. The specular reflectance model, when coupled with a diffuse leaf model, would predict both the specular and diffuse portions of the reflectance factor. The specular model predicts and the data analysis confirms that the single variable, angle of incidence of specularly reflected sunlight on the leaf, explains much of variation in the polarization data as a function of view-illumination directions. Author

N86-13799*# Hunter Coll., New York.
GEOMETRIC-OPTICAL MODELING OF A CONIFER FOREST CANOPY
Alan H. Strahler, Principal Investigator *In* NASA. Goddard Space Flight Center. Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 67-71 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 20F

The objective of this research is to explore how the geometry of trees in forest stands influences the reflectance of the forest as imaged from space. Most plant canopy modeling has viewed the canopy as an assemblage of plane-parallel layers on top of a soil surface. For these models, leaf angle distribution, leaf area index, and the angular transmittance and reflectance of leaves are the primary optical and geometric parameters. Such models are now sufficiently well developed to explain most of the variance in angular reflectance measurements observed from homogeneous plant canopies. However, forest canopies as imaged by airborne and spaceborne scanners exhibit considerable variance at quite a different scale. Brightness values vary strongly from one pixel to the next primarily as a function of the number of trees they contain. At this scale, the forest canopy is nonuniform and discontinuous. This research focuses on a discrete-element, geometric-optical view of the forest canopy. Author

N86-13800*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
CROP CHARACTERISTICS RESEARCH: GROWTH AND REFLECTANCE ANALYSIS
G. D. Badhwar, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 72-78 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

Much of the early research in remote sensing follows along developing spectral signatures of cover types. It was found, however, that a signature from an unknown cover class could not always be matched to a catalog value of known cover class. This approach was abandoned and supervised classification schemes followed. These were not efficient and required extensive training. It was obvious that data acquired at a single time could not separate cover types. A large portion of the proposed research has concentrated on modeling the temporal behavior of agricultural crops and on removing the need for any training data in remote sensing surveys; the key to which is the solution of the so-called 'signature extension' problem. A clear need to develop spectral estimaters of crop ontogenic stages and yield has existed even though various correlations have been developed. Considerable effort in developing techniques to estimate these variables was devoted to this work. The need to accurately evaluate existing canopy reflectance model(s), improve these models, use them to understand the crop signatures, and estimate leaf area index was the third objective of the proposed work. A synopsis of this research effort is discussed. Author

N86-13801*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GROUND REFLECTANCE MEASUREMENTS FROM THEMATIC MAPPER DATA
James E. Conel, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 79-85 refs ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 08B

Satellite radiance data are measures of solar radiation that has been reflected by the Earth's surface and scattered and absorbed by atmospheric gases and aerosols. Of concern to geologists are the surface reflectance and the degrading effects on surface resolution and albedo contrast introduced by atmospheric phenomena. The objects of this research have been to: (1) provide an empirical relationship between scanner radiance and ground reflectance allowing interpretation of the satellite data in terms of the surface parameter, and (2) assess the precision with which surface spectral reflectance may be recovered from LANDSAT-4 TM. data in the presence of perturbing atmospheric and instrumental factors. The approach is field-oriented, and utilizes ground observations of surface spectral reflectance with portable spectrometers and radiometers to develop the required empirical relationships. Author

N86-13802*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THERMAL INFRARED GEOLOGIC REMOTE SENSING

RESEARCH AT THE JET PROPULSION LABORATORY

Mary Jane Bartholomew and Anne B. Kahle, Principle Investigators *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 86-92 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sious Falls, S.D. 57198 ERTS (For primary document see N86-13794 04-43)

Avail: NTIS HC A09/MF A01 CSCL 08G

Remotely sensed thermal infrared spectral data have great potential to improve rock type discrimination if the factors that control thermal infrared spectral reflection and emission can be better understood. Improved rock type discrimination in turn leads to better and more efficient geologic mapping which is carried out in the exploration, assessment and documentation of mineral resources and geologic hazards. Geologic maps also contribute significantly to the understanding of the natural history of the Earth and neighboring planetary bodies. Author

N86-13803*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ATMOSPHERIC AND SCIENCE COMPLEXITY EFFECTS ON SURFACE BIDIRECTIONAL REFLECTANCE

David J. Diner, Principal Investigator, John V. Martonchik, William D. Sythe, and Charles Hessom (California Univ., Los Angeles) *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 93-99 ERTS (For primary document see N86-13794 04-43)

Avail: NTIS HC A09/MF A01 CSCL 20F

Among the tools used in passive remote sensing of Earth resources in the visible and near-infrared spectral regions are measurements of spectral signature and bidirectional reflectance functions (BDRFs). Determination of surface properties using these observables is complicated by a number of factors, including: (1) mixing of surface components, such as soil and vegetation, (2) multiple reflections of radiation due to complex geometry, such as in crop canopies, and (3) atmospheric effects. In order to bridge the diversity in these different approaches, there is a need for a fundamental physical understanding of the influence of the various effects and a quantiative measure of their relative importance. In particular, we consider scene complexity effects using the example of reflection by vegetative surfaces. The interaction of sunlight with a crop canopy and interpretation of the spectral and angular dependence of the emergent radiation is basically a multidimensional radiative transfer problem. The complex canopy geometry, underlying soil cover, and presence of diffuse as well as collimated illumination will modify the reflectance characteristics of the canopy relative to those of the individual elements. Author

N86-13804*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ATMOSPHERIC EFFECT ON REMOTE SENSING OF THE EARTH'S SURFACE

Robert S. Fraser and Yoram J. Kaufman, Principal Investigators (Maryland Univ., College Park) *In its* Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 100-106 ERTS (For primary document see N86-13794 04-43)

Avail: NTIS HC A09/MF A01 CSCL 08G

Radiative transfer theory (RT) for an atmosphere with a nonuniform surface is the basis for understanding and correcting for the atmospheric effect on remote sensing of surface properties. In the present work the theory is generalized and tested successfully against laboratory and field measurements. There is still a need to generalize the RT approximation for off-nadir directions and to take into account anisotropic reflectance at the surface. The reflectance at the surface. The adjacency effect results in a significant modification of spectral signatures of the surface, and therefore results in modification of classifications, of separability of field classes, and of spatial resolution. For example, the 30 m resolution of the Thematic Mapper is reduced to 100 m by a hazy atmosphere. The adjacency effect depends on several optical parameters of aerosols: optical thickness, depth of aerosol layer, scattering phase function, and absorption. Remote sensing in general depends on these parameter, not just adjacency effects, but they are not known well enough for making accurate atmospheric corrections. It is important to establish methods for estimating these parameters in order to develop correction methods for atmospheric effects. Such estimations can be based on climatological data, which are not available yet, correlations between the optical parameters and meteorological data, and the same satellite measurements of radiances that are used for estimating surface properties. Knowledge about the atmospheric parameters important for remote sensing is being enlarged with current measurements of them. Author

N86-13805*# EG and G Washington Analytic Services Center, Inc., Lanham, Md.

THE CHARACTERIZATION OF SURFACE VARIGATION EFFECTS ON REMOTE SENSING

William A. Pearce, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 107-113 ERTS (For primary document see N86-13794 04-43)

Avail: NTIS HC A09/MF A01 CSCL 20F

Improvements in remote sensing capabilities hinge very directly upon attaining an understanding of the physical processes contributing to the measurements. In order to devise new measurement strategies and to learn better techniques for processing remotely gathered data, it is necessary to understand and to characterize the complex radiative interactions of the atmosphere-surface system. In particular, it is important to understand the role of atmospheric structure, ground reflectance inhomogeneity and ground bidirectional reflectance type. The goals, then, are to model, analyze, and parameterize the observable effects of three dimensional atmospheric structure and composition and two dimensional variations in ground albedo and bidirectional reflectance. To achieve these goals, a Monte Carlo radiative transfer code is employed to model and analyze the effects of many of the complications which are present in nature. Author

N86-13806*# Los Alamos National Lab., N. Mex. Theoretical Div.

MULTIDIMENSIONAL MODELING OF ATMOSPHERIC EFFECTS AND SURFACE HETEROGENEITIES ON REMOTE SENSING

S. A. W. Gerstl, C. Simmer, and A. Zardecki, Principal Investigators *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 114-119 ERTS (For primary document see N86-13794 04-43)

Avail: NTIS HC A09/MF A01 CSCL 04A

The overall goal of this project is to establish a modeling capability that allows a quantitative determination of atmospheric effects on remote sensing including the effects of surface heterogeneities. This includes an improved understanding of aerosol and haze effects in connection with structural, angular, and spatial surface heterogeneities. One important objective of the research is the possible identification of intrinsic surface or canopy characteristics that might be invariant to atmospheric perturbations so that they could be used for scene identification. Conversely, an equally important objective is to find a correction algorithm for atmospheric effects in satellite-sensed surface reflectances. The technical approach is centered around a systematic model and code development effort based on existing, highly advanced computer codes that were originally developed for nuclear radiation shielding applications. Computational techniques for the numerical solution of the radiative transfer equation are adapted on the basis of the discrete-ordinates finite-element method which proved highly successful for one and two-dimensional radiative transfer problems with fully resolved angular representation of the radiation field. Author

N86-13807*# Texas Univ., Arlington. Dept. of Electrical Engineering.

SCATTERING MODELS AND BASIC EXPERIMENTS IN THE MICROWAVE REGIME

A. K. Fung and A. J. Blanchard, Principal Investigators *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci.

Res. Program Sep. 1985 p 120-125 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 20N

The objectives of research over the next three years are: (1) to develop a randomly rough surface scattering model which is applicable over the entire frequency band; (2) to develop a computer simulation method and algorithm to simulate scattering from known randomly rough surfaces, Z(x,y); (3) to design and perform laboratory experiments to study geometric and physical target parameters of an inhomogeneous layer; (4) to develop scattering models for an inhomogeneous layer which accounts for near field interaction and multiple scattering in both the coherent and the incoherent scattering components; and (5) a comparison between theoretical models and measurements or numerical simulation. Author

N86-13808*# Massachusetts Inst. of Tech., Cambridge.
REMOTE SENSING OF EARTH TERRAIN
Jin Au Kong, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 126-129 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 08B

The objective of this research is to develop theoretical models that are useful and practical in the remote sensing of the Earth environment including the Earth terrain, the lower and the upper atmospheres. Various models applicable to the microwave remote sensing of vegetation, snow-ice, and atmospheric precipitation have been developed. Such studies shall be extended to the higher frequency range to unify the optical band and the microwave theoretical foundations. The study, which had an emphasis on vegetation canopy to include all terrain media, and the whole Earth environment will be extended. A data base will be developed to generate scene radiation characteristics which will benefit the studies of global inhabitability, meteorological applications, and crop yield. Author

N86-13809*# George Washington Univ., Washington, D.C. Dept. of Electrical Engineering.
DISCRETE RANDOM MEDIA TECHNIQUES FOR MICROWAVE MODELING OF VEGETATED TERRAIN
Roger H. Lang, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 130-135 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 08B

Microwave remote sensing of vegetated terrain has been studied. Vegetation is modeled so that backscattered radar signals can be used to infer parameters which characterize the vegetation and underlying ground. The vegetation is modeled by discrete lossy dielectric scatterers with prescribed characteristics. The goal of the modeling effort is to remotely sense vegetation type (classification), growth stage, and plant/ground moisture. This information can then be used as input into agricultural, forestry and global circulation models. The microwave frequency spectrum, particularly L and C bands, are especially appropriate for this purpose since the wavelength is comparable to plant leaf and stem size. The resulting resonant interaction leads to backscattered data highly depend on plant shape and orientation. In addition, the transparent nature of the atmosphere in this frequency regime allows for algorithm development which requires no atmospheric correction. Author

N86-13810*# Michigan Univ., Ann Arbor. Radiation Lab.
MICROWAVE DIELECTRIC AND PROPAGATION PROPERTIES OF VEGETATION CANOPIES
Fawwaz T. Ulaby, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 136-141 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 20N

A vegetation canopy is a highly inhomogeneous medium at microwave frequencies, and because the scattering elements (leaves, stalks, fruits, and branches) have a nonuniform distribution in orientation, the canopy is likely to exhibit nonisotropic attenuation properties. In some canopies, the stalk may contain the overwhelming majority of the plant's biomass, which suggests that an incident radar wave would be differentially attenuated by the canopy depending on the direction of the incident electric field relative to the stalks' orientation. The propagation properties of a vegetation canopy play a central role in modeling both the backscattering behavior observed by an imaging radar and the emission observed by a radiometer. These propagation properties are in turn governed by the dielectric properties and the size, shape, and slope distributions of the scatteres. In spite of the critical need for canopy propagation models and experimental data, very few investigations had been conducted (prior to this study) to determine the extinction properties of vegetation canopies, either by constituent type (leaves, stalks, etc.) or as a whole. Author

N86-13811*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DETERMINATION OF BACKSCATTERING SOURCES IN VARIOUS TARGETS
R. K. Moore, R. Zoughi, and L. K. Wu, Principal Investigators *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 142-147 refs ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 20N

The objectives of this research are to identify the primary contributors to 10 GHz radar backscatter from various natural and man-made surfaces and objects, and to use this information in developing new and better models for the scatter. When the true sources are known for the scattering that leads to variation in intensity on radar images, the images (and sets of them) may be interpreted more meaningfully in terms of the variation of parameters of interest for science or application. For example, better interpretation of vegetation images may be possible for yield forecasting and stress detection. Author

N86-13812*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ACTIVE MICROWAVE PROPERTIES OF VEGETATION CANOPIES
Jack F. Paris, Principal Investigator *In* NASA. Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program Sep. 1985 p 148-153 ERTS (For primary document see N86-13794 04-43)
Avail: NTIS HC A09/MF A01 CSCL 20N

Potential users of radar imagery need a better fundamental understanding of the capabilities of radar systems for vegetation studies than past studies provide. One approach is the use of theoretical models to predict observable active microwave properties of vegetation. This in turn requires accurate observations of backscattering coefficients and other active microwave properties in field research studies. The background document for the SRAEC program emphasizes the need to relate electromagnetic parameters to classical biophysical descriptors and to understand the role of polarization, especially cross-polarization. The broad goal of this study is to increase the understanding of the effects of canopy structure on the active microwave properties of vegetation canopies, with particular attention to polarization. Author

N86-13813*# Raytheon Co., Sudbury, Mass. Electro-Optics Systems Lab.
PRECISION POINTING USING A DUAL-WEDGE SCANNER Final Report
Christopher T. Amirault and Charles A. DiMarzio Washington NASA Nov. 1985 35 p refs
(Contract NAS8-33120)
(NASA-CR-3946; NAS 1.26:3946) Avail: NTIS HC A03/MF A01 CSCL 20E

A system was developed for calibrating and precisely pointing a germanium dual-wedge scanner for a CO2 Doppler lidar from an airborne platform. The equations implemented in pointing the scanner and those in the iterative calibration program, which

combines available data with estimated parameters of the scanner orientation relative to the axes of the aircraft's inertial navigation system to arrive at corrected scanner parameters are described. The effect of specific error conditions on program performance and the results of the program when used on 1981 test data are investigated. E.A.K.

N86-13814*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
CROP AREA ESTIMATION BASED ON REMOTELY-SENSED DATA WITH AN ACCURATE BUT COSTLY SUBSAMPLE Final Report, 1 Jan. 1984 - 31 Aug. 1985
Richard F. Gunst 31 Aug. 1985 33 p refs
(Contract NCC9-9)
(NASA-CR-176017; NAS 1.26:176017) Avail: NTIS HC A03/MF A01 CSCL 02C

Research activities conducted under the auspices of National Aeronautics and Space Administration Cooperative Agreement NCC 9-9 are discussed. During this contract period research efforts are concentrated in two primary areas. The first are is an investigation of the use of measurement error models as alternatives to least squares regression estimators of crop production or timber biomass. The secondary primary area of investigation is on the estimation of the mixing proportion of two-component mixture models. This report lists publications, technical reports, submitted manuscripts, and oral presentation generated by these research efforts. Possible areas of future research are mentioned. Author

N86-13815# Battelle Inst., Frankfurt am Main (West Germany).
GENERICALLY BASED MOBILITY-TERRAIN DATA BASES Interim Report, Dec. 1984 - Apr. 1985
W. Koeppel and P. Jessl Apr. 1985 4 p
(Contract DAJA45-84-C-0039)
(AD-A157738; R/D-4739-EN-01; IR-2) Avail: NTIS HC A02/MF A01 CSCL 05/2

This document describes three tasks: (1) Concerning task 1-development of a method of assembling generically-based mobility terrain data bases; areas were identified within the generic terrain regions where the classification system output was compared with available CCM-mapping products and recently assembled terrain information on german water-folio products; (2) Task 2 concerns initiation of the development of a procedure for quantitatively estimating the reliability of generically-based mobility terrain data bases; (3) Concerning Task 3 initiation of the development of a procedure for determining the relations among soil dynamic parameters and conventional mobility index numbers (or descriptors) repetitively testing of shear load-displacement behavior was performed within transitional weather period conditions of December 1984 and April 1985 at six sites within the vicinity of Frankfurt. GRA

N86-13816# Wyoming Univ., Laramie. Dept. of Geology and Geophysics.
GEOTHERMAL RESOURCES OF THE WIND RIVER BASIN, WYOMING
B. S. Hickley and H. P. Heasler 1985 58 p refs
(Contract DE-FC07-79ID-12026)
(DE85-016969; DOE/ID-12026/T14) Avail: NTIS HC A04/MF A01

The geothermal resources of the Wind River Basin were investigated. Oil-well bottom-hole temperatures, thermal logs of wells, and heat flow data were interpreted within a framework of geologic and hydrologic constraints, basic thermal data, which includes the background thermal gradient and the highest recorded temperature and corresponding depth for each basin, is tabulated. Background heat flow in the Wind River Basin is generally insufficient to produce high conductive gradients. Only where hydrologic systems re-distribute heat through mass movement of water will high temperatures occur at shallow depths. Aquifers which may be have the confinement and structural characteristics necessary to create such geothermal systems are the Lance/Fort Union, Mesa Verde, Frontier, Muddy, Cloverly, Sundance, Nugget, Park City, Tensleep, Amsden, Madison, Bighorn, and Flathead Formations. Of these the Tensleep Sandstone and Madison Limestone are the most attractive in terms of both productivity and water quality. Most of the identified geothermal anomalies in the Wind River Basin occur along complex structures in the southwest and south. The most attractive geothermal prospects identified are anomalous Areas 2 and 3 north of Lander, Sweetwater Station Springs west of Jeffrey City, and the thermal springs southwest of Dubois. Even in these areas, it is unlikely temperatures in excess of 130 to 150(0)F can be developed. DOE

N86-13817# Oak Ridge National Lab., Tenn.
UNUSUAL OCCURRENCE OF MAGHEMITE IN SOILS DEVELOPED ON KNOX GROUP DOLOSTONES
O. C. Kopp and S. Y. Lee 1985 26 p refs Presented at Intern. Clay Mater. Conf., Denver, 28 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-017158; CONF-850775-1) Avail: NTIS HC A03/MF A01

Maghemite, (GAMMA)-Fe2O3, occurred in soils developed from residuum of Knox group dolostones (Cambro-Ordovician age) along Chestnut Ridge on the US Department of Energy Oak Ridge Reservation in Oak Ridge, Tennessee. The parent dolostones in the area, although exposed to weathering, were free of maghemite and magnetite. Scanning electron micrographs and electron probe analyses indicated that the maghemite occurred in several textural types, including replaced oolites, cemented siltstones, and massive to botryoidal material. The most complex replacement by maghemite was revealed by the oolitic texture variety. Oolitic limestone was dolomitized, as revealed by the presence of numerous rhombs, during early diagenesis. During a period of silicification dolomite rhombs were replaced, and much of the remaining oolites and carbonate cements may have been partially replaced. More recently, after uplift and erosion brought these oolitic cherts into the upper weathering zone, the cherts were replaced by iron oxides. Massive chert and siltstone grains in all stages of replacement have been observed. The replacing iron in the soil solution may have originated from ferrous-ferric hydroxide, carbonate, or organic complexes. The replaced iron was converted to maghemite and hematite through dehydration and slow oxidation during pedogenesis. DOE

N86-13818# California Univ., Davis.
CALIFORNIA WATER RESOURCES INSTITUTE PROGRAM FOR 1983 Final Report
J. H. Snyder, J. DeVries, and R. J. Woods Sep. 1984 22 p
(PB85-225837; USGS/G-830-01) Avail: NTIS HC A02/MF A01 CSCL 08H

A synopsis is given of the results of research projects sponsored under Grant Program g-830, the 1083 Water Research Institute Program (WRIP) for the University of California's Water Resources Center. The California WRIP package is a subset of the Center's overall research program effort and contains six one year projects investigating the following areas: clarification of surface waters for recharge through wells, temperature requirements of pacific coastal stream fishes, the implications of total water demand from the adoption of drip irrigation in western agriculture, an economic approach to the estimation of dynamic production function for an irrigated crop, channel and flow relationships in tidal salt marsh wetlands, and chaparral management effects on water and the environment. GRA

N86-13819# Technicolor Government Services, Inc., Fort Collins, Colo.
MAP PROJECTIONS FOR USE WITH THE GEOGRAPHIC INFORMATION SYSTEM
J. E. Lee and J. M. Walsh Jul. 1984 73 p refs
(Contract DE-14-16-0009-83-001)
(PB85-198992; FWS/OBS-84/17) Avail: NTIS HC A04/MF A01 CSCL 08B

This document has been prepared to assist users of the Geographic Information System (GIS), originally developed at the Western Energy and Land Use Team (WELUT), in understanding and using the various map projections which are available. Currently, 20 map projections may be used in the GIS. Users who

have been trained in the component software systems of the GIS MOSS (Map Overlay and Statistical System), COS (Cartographic Output System), and AMS (Analytical Mapping System), and who have some introduction to principles of cartography, will find this document most helpful. Author (GRA)

N86-13775*# Joint Publications Research Service, Arlington, Va.
AERIAL LASER SENSING OF OCEAN UPPER LAYER Abstract Only
D. V. Vlasov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 19 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 433-441 (For primary document see N86-13765 04-43)
Avail: NTIS HC A04/MF A01

N86-13777# Joint Publications Research Service, Arlington, Va.
VOLCANOES DISCOVERED WITH RADIO BEAM Abstract Only
In its USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 21 Transl. into ENGLISH from Tass (Moscow), 16 May 1985 (For primary document see N86-13765 04-43)
Avail: NTIS HC A04/MF A01

N86-13778# Joint Publications Research Service, Arlington, Va.
COMPUTER-AIDED AERIAL RADIOMETRIC SURVEYING OF SOIL MOISTURE Abstract Only
N. Armand *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 24 Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 30 Jun. 1985 p 2 (For primary document see N86-13765 04-43)
Avail: NTIS HC A04/MF A01

N86-14168# Joint Publications Research Service, Arlington, Va.
PRESSURE FIELD RETRIEVAL BY REMOTE REFRACTOMETRY FROM SPACE Abstract Only
A. S. Gurvich and S. V. Sokolovskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 106 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atm. i Okeana (Moscow), v. 21, no. 1, Jan. 1985 p 12-21 Original language document announced in IAA as A85-26291 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14170# Joint Publications Research Service, Arlington, Va.
STEREOPHOTOGRAMMETRIC SURVEY OF WAVE-COVERED WATER SURFACE Abstract Only
M. V. Shulmin, Yu. I. Kuchinskiy, and M. P. Shulmina *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 107-108 Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 11, Nov. 1984 p 33-35 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14172# Joint Publications Research Service, Arlington, Va.
USE OF REMOTE OPTICAL MEASUREMENTS IN AGRICULTURE Abstract Only
G. I. Belchanskiy, K. Ya. Kondratyev, V. V. Kozoderov, N. V. Sazonov, A. G. Topchiyev, and P. P. Fedchenko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 109-110 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 8-24 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14173# Joint Publications Research Service, Arlington, Va.
CLASSIFICATION OF TREES BY GROWTH CLASSES ON THE BASIS OF MULTIZONAL PHOTOGRAPHS Abstract Only
A. N. Borisov, V. A. Ivanov, G. A. Ivanchenko, V. S. Kirichuk, and V. V. Kuzmichev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 110 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 25-30 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14174# Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN COMPLEX MAPPING OF NATURAL RESOURCES IN AGRARIAN-INDUSTRIAL REGIONS OF NON-CHERNOZEM RSFSR USING SPACE PHOTOMATERIALS Abstract Only
V. A. Sushchenya, L. A. Shevchenko, and V. I. Somova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 111 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 31-40 Original language document announced in IAA as A85-16941 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14175# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USE OF AEROSPACE MATERIALS IN PREDICTING OCCURRENCE OF PETROLEUM AND GAS Abstract Only
R. A. Bidzhiyev and L. M. Natapov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 112 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 41-50 Original language document announced in IAA as A85-16942 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14176# Joint Publications Research Service, Arlington, Va.
PROBLEMS IN STUDY AND EVALUATION OF CONSEQUENCES OF FOREST FIRES USING AEROSPACE PHOTOGRAPHS Abstract Only
V. V. Furyayev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 113 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 51-57 Original language document announced in IAA as A85-16943 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14177# Joint Publications Research Service, Arlington, Va.
COMPUTATION OF REFLECTION OF SOLAR RADIATION FROM VEGETATION COVER BY MONTE-CARLO METHOD Abstract Only
Yu. K. Ross and A. L. Marshak *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 114 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 58-67 Original language document announced in IAA as A85-16944 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14178# Joint Publications Research Service, Arlington, Va.
REFLECTION INDICATRICES OF VEGETATION CANOPIES Abstract Only
A. Kuusk, Ya. Anton, T. Nilson, U. Peterson, K. Ross, Yu. Ross, and A. Savikhin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 115 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 68-75 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14179# Joint Publications Research Service, Arlington, Va.
APPROXIMATE ANALYTICAL FORMULAS FOR COMPUTING SPECTRAL BRIGHTNESS COEFFICIENTS FOR AGRICULTURAL VEGETATION Abstract Only
T. Nilson and A. Kuusk *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 116 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 76-83 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14180# Joint Publications Research Service, Arlington, Va.
METHOD FOR USING CLUSTERS IN EVALUATING LAND USE AREAS FROM MULTIZONAL PHOTOGRAPHS Abstract Only
L. N. Vasilyev and R. Kachinski *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 117 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 94-99 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14181# Joint Publications Research Service, Arlington, Va.
METHODS FOR COMPLEX SPACE EXPERIMENT IN USSR FOR STUDYING LAND FROM MANNED SPACECRAFT Abstract Only
B. V. Vinogradov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 118 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 100-106 Original language document announced in IAA as A85-16946 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14182# Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN CONDUCTING SUBSATELLITE EXPERIMENTS WITH WATER BODIES IN USSR AND HUNGARIAN PEOPLE'S REPUBLIC Abstract Only
I. F. Berestovskiy, A. A. Gitelson, D. Sabo, and F. Siladi *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 119 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 107-111 Original language document announced in IAA as A85-16947 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14183# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USING SPACE SURVEY FOR STUDYING SEASONAL CHANGES OF LANDSCAPES IN SOME REGIONS OF USSR Abstract Only
I. N. Yelagin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 120 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 112-114 Original language document announced in IAA as A85-16948 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14184# Joint Publications Research Service, Arlington, Va.
ROLE OF LANDSCAPE RESEARCH IN DEVELOPMENT OF SPACE METHODS FOR STUDYING EARTH Abstract Only
Ye. V. Glushko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 121 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 115-121 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14186# Joint Publications Research Service, Arlington, Va.
APPLICATION OF STATISTICAL MODEL OF LAYERED MEDIUM FOR COMPUTING THERMAL EMISSION OF ICE COVERS Abstract Only
V. L. Brekhovskikh *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 122-123 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 33-38 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14187# Joint Publications Research Service, Arlington, Va.
COMPILATION OF LANDSCAPE MAPS AT DIFFERENT SCALES WITH USE OF SPACE PHOTOINFORMATION Abstract Only
V. I. Ryabchikova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 123 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 39-45 Original language document announced in IAA as A84-49029 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14190# Joint Publications Research Service, Arlington, Va.
USE OF GOUDRIAAN MODEL FOR STUDYING REFLECTION REGULARITIES IN VEGETATION-SOIL SYSTEM IN OPTICAL RANGE. 1: INFLUENCE OF PHYTOMETRIC PARAMETERS ON SPECTRAL BRIGHTNESS COEFFICIENTS Abstract Only
N. N. Vygodskaya and I. I. Gorshkova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 126 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 61-70 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14191# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF SURVEY CONDITIONS AND EFFECT OF NOISE ON QUALITY OF SENSING OF SOIL FORMATIONS Abstract Only
A. B. Karasev and S. V. Pantyukhov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 127 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 71-80 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14192# Joint Publications Research Service, Arlington, Va.
NORMALIZATION OF RESPONSE OF RADIOMETRIC INSTRUMENTATION FOR STUDYING EARTH'S NATURAL RESOURCES Abstract Only
G. K. Kholopov, R. Sh. Khisamov, and F. G. Khuzin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 128 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 81-88 Original language document announced in IAA as A84-49032 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14193# Joint Publications Research Service, Arlington, Va.
RADIOMETRIC CORRECTION OF MATERIALS OF AEROSPACE SURVEY OF EARTH WITH MKF-6 CAMERA: METHODOLOGY AND USE OF RESULTS Abstract Only
Kh. A. LopesFalkon *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 129 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 89-94 Original language document announced in IAA as A84-49033 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14194# Joint Publications Research Service, Arlington, Va.
SOME APPROACHES TO ORGANIZATION OF DATA BANK IN SYSTEM FOR STUDYING EARTH'S NATURAL RESOURCES FROM SPACE (USING EXAMPLE OF AGRICULTURE) Abstract Only
Yu. G. Simonov, N. F. Derevyanko, and G. I. Barvyn *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 130 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 103-109 Original language document announced in IAA as A84-49035 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14195# Joint Publications Research Service, Arlington, Va.
EXPERIMENT FOR EVALUATING ACCURACY IN DETERMINING LAND CATEGORIES ON SPACE SCANNER PHOTOGRAPHS Abstract Only
R. I. Elman, Ye. V. Bakhtinova, A. N. Potapov, R. V. Sviridova, and L. A. Bersneva *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 131 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 110-119 Original language document announced in IAA as A84-49036 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14196# Joint Publications Research Service, Arlington, Va.
REMOTE TEMPERATURE DETERMINATION OF TERRESTRIAL COVERS FROM POLARIZATION INVARIANT OF MICROWAVE-RADIOTHERMAL EMISSION Abstract Only
G. A. Andreyev, L. F. Borodin, L. V. Zayentsev, and S. N. Rubtsov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 132 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 120-123 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-13820# Kernforschungsanlage, Juelich (West Germany). Projekteitung Energieforschung.
IMPLEMENTING AGREEMENT FOR COOPERATION IN THE DEVELOPMENT OF LARGE SCALE WIND ENERGY CONVERSION SYSTEMS
Mar. 1985 182 p refs Partly in ENGLISH and GERMAN Proc. of 12th Meeting of Experts on Aerodyn. Calculational Methods for WECS; sponsored by Bundesministerium fuer Forschung und Technologie and Technical Univ. of Denmark
(Juel-Spez-304; ISSN-0343-7639) Avail: NTIS HC A09/MF A01

Wind energy converter aerodynamics and turbulence; rotor tip vane performance; performance prediction; airfoil characteristics; rotor performance; and simulation models were discussed. For individual titles, see N86-13821 through N86-13830.

N86-13821# Stuttgart Univ. (West Germany). Inst. fuer Aerodynamik und Gasdynamik.
POLAR MEASUREMENTS ON THE PROFILES: FX 84-w-097, FX 84-w-127, FX 84-w-140, FX 84-w-175, FX 84-w-218 [POLARENMESSUNGEN AN DEN PROFILEN: FX 84-W-097, FX 84-W-127, FX 84-W-140, FX 84-W-175, FX 84-W-218]
D. Althaus *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 3-28 In GERMAN (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

Wind tunnel data on wind turbine blade models in a laminar tunnel at Reynolds numbers between 700,000 and 1.5 million are presented. Flow distribution and velocity data are shown.
Author (ESA)

N86-13822# McAlpine (Sir Robert) and Sons, London (England).
DEVELOPMENT IN AERODYNAMIC CALCULATIONS
Mike B. Anderson *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 29-39 (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

An unsteady aerodynamics models for simulating large wind energy converters is described. For the attached flow region the loads are calculated via a generalized indicial lift function based on the Wagner function. The angle of attack is defined at the 3/4 chord location and thus pitching velocity and virtual mass terms are included. Leading edge stall is incorporated by a simple time delay based on distance travelled in semichord. Trailing edge stall is incorporated via Kirchhoff's law and two first order lags. Time domain simulation of single point power spectra of velocity fluctuations, and coherence function estimates are compared with measurements. Author (ESA)

N86-13823# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
AN ANALYTICAL THEORY FOR ROTOR TIP VANE PERFORMANCE AND COMPARISON WITH EXPERIMENTAL RESULTS
Theo vanHolten *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 41-57 refs (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

A theoretical method for the performance estimation of tip vane wind turbines was developed to analyze overall forces, total power, and average velocities. It assumes an infinite number of turbines blades and tip vanes. The flow model is equivalent to a time averaged analysis. The model assumes small disturbances, which means that free vorticity convects along trajectories parallel to the undisturbed velocity. Agreement with experiment is satisfactory. Author (ESA)

N86-13824# Central Electricity Generating Board, London (England).
AEROFOIL CHARACTERISTICS OF ROTATING BLADES
David T. Milborrow and J. N. Ross *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 59-68 refs (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

To assess the possibilities of using wind turbine models of modest size for studies of aerodynamic performance and wakes, a study to measure, as directly as possible from rotating blades, angles of attack and the corresponding lift coefficients, using, respectively, the nonintrusive properties of laser anemometery, and small total pressure probes with a wide angle of acceptance was initiated. Measurements at radial stations on a rotating model wind turbine blade yield lift coefficients higher than two dimensional values in the post-stall region, less than fan test results. The study yields drag coefficients higher than two dimensional values, but this may be a function of the small scale of the experiment.
Author (ESA)

N86-13825# Aeronautical Research Inst. of Sweden, Bromma.
UNSTEADY AERODYNAMICS APPLIED TO THE HORIZONTAL AXIS WIND TURBINE DISK
Bjoern Montgomerie *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 69-82 (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

A calculation method to yield external forces in the equations of motion for a complete elastic structure horizontal axis wind turbine elastic model, which includes unsteady effects for improved time history (simulation) and force calculation, and limits the volume of the unsteady method to reduce computer runs was developed. Standard aerodynamic methods are implemented as a part of the complete method. The unsteady effects are applied to the aerodynamic induction factor, to allow easy addition and inclusion of the unsteady effects in an existing method for aerodynamic force calculation. Author (ESA)

N86-13826# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
AERODYNAMIC THEORY IN THE CALCULATION OF THE GROWIAN ROTOR COMPARED WITH SOME EXPERIMENTAL DATA
Reinhold Pernpeintner, G. Huss, and E. Hau *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 83-96 refs (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

The strip (or blade element) theory for predicting wind turbine rotor performance is compared with wind tunnel data, performance measurements on a large unit, and other prediction methods. Comparison of measured and calculated power curves shows that the blade element theory is sufficient in stationnary operation. When comparing the aerodynamic loads on the rotor blades for different load cases, the blade element theory is an excellent, and quick, tool for calculations. Only for cases with fast instationary operation conditions are there differences between theoretical modeling and measurement which cannot be neglected. The limits of the validity of the stationary theory are reached under these conditions. Author (ESA)

N86-13827# Riso National Lab., Roskilde (Denmark).
AERODYNAMIC PERFORMANCE OF A NEW LM 17.2 M ROTOR
Flemming Rasmussen *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 97-102 refs (For primary document see N86-13820 04-44)

Avail: NTIS HC A09/MF A01

The aerodynamic properties of a 17.2 m diameter rotor mounted on a 55 kW windmill were measured. Power curves were measured for a range of blade tip angles to find the best angle in relation to energy production and stalling characteristics. With this optimum blade setting the flapwise blade root bending moment was measured as a function of wind speed. The drag coefficient at 90 deg angle of attack was calculated from measurements of the integrated value, i.e., the flapwise blade root bending moment as a function of wind speed during stand still. Profile properties are estimated from aerodynamic calculations, and the results compared to profile data from three dimensional wind tunnel measurements. The flapwise blade root bending moment versus blade angular position during one revolution was measured in skew wind and compared with calculations. The influence of surface roughnes introduced at a certain percentage of the section chord and the dependency on the Reynolds number is investigated, and discussed from observed discrepancies in the measured power curves. Author (ESA)

N86-13828# National Aerospace Lab., Amsterdam (Netherlands).
AERODYNAMIC RESEARCH ON WIND TURBINES AT NLR
Otto deVries *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 103-151 refs (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

The aerodynamic calculation of a horizontal axis wind turbine in a steady and homogeneous flow is described. An empirical extension of a blade element calculation method into the turbulent wake state is outlined. Calculations with a vortex method, based on a lifting-line approximation, with a relaxed vortex wake are compared with results from blade element theory and with experiment. Yaw stability at small yaw angles is considered.
Author (ESA)

N86-13829# Midwest Research Inst., Golden, Colo. Wind Energy Research Center.
AERODYNAMIC RESEARCH EFFORTS AT SERI WIND ENERGY RESEARCH CENTER AT ROCKY FLATS
James L. Tangler *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 153-159 refs Sponsored by US Department of Energy (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

Performance prediction and enhancement of horizontal axis wind turbines (HAWT) are discussed. A general purpose blade-element/momentum code was developed for rapid parametric studies and for use in annual energy calculations. A post-stall airfoil data synthesization routine accounts for blade aspect ratio effects. A version of the performance code provides better determination of dynamic stall effects on blade loads and performance as influenced by machine yaw angle, unsteady winds, tower shadow, and wind shear. For detailed wind turbine blade optimization, a more sophisticated lifting-surface/prescribed-wake analysis was developed. This code is a transfer of state-of-the-art helicopter theory into a wind turbine design analysis. Airfoil design effort is directed toward satisfying the need to tailor airfoil characteristics specifically for HAWT's. The design criteria and status of this effort are presented. Author (ESA)

N86-13830# National Research Council of Canada, Ottawa (Ontario).
AERODYNAMIC CALCULATIONAL METHODS FOR CURVED-BLADE DARRIEUS VAWT WECS
R. J. Templin *In* Kernforschungsanlage Aerodyn. Calculation Methods for Wind Energy Converters (WECS) Mar. 1985 p 161-172 refs (For primary document see N86-13820 04-44)
Avail: NTIS HC A09/MF A01

Calculation of aerodynamic performance and load distributions for curved-blade wind turbines is discussed. Double multiple stream tube theory, and the uncertainties that remain in further developing adequate methods are considered. The lack of relevant airfoil data at high Reynolds numbers and high angles of attack, and doubts concerning the accuracy of models of dynamic stall are underlined. Wind tunnel tests of blade airbrake configurations are summarized. Author (ESA)

N86-13831# Rasor Associates, Inc., Sunnyvale, Calif.
CLOSE-SPACED HIGH TEMPERATURE KNUDSEN FLOW Annual Report, 16 May 1984 - 15 May 1985
J. B. McVey 15 Jun. 1985 16 p
(Contract F49620-83-C-0068)
(AD-A158280; NSR-22-3; AFOSR-85-0576TR) Avail: NTIS HC A02/MF A01 CSCL 10/2

This work continued to investigate thermionic energy conversion in the Knudsen (collisionless) operating mode. A SAVTEC-type converter with an interelectrode spacing of 18 to 22 microns was tested over a range of emitter temperatures up to about 1700 K. Maximum performance followed the predictions of vacuum-mode analysis for emitter temperatures below 1580 K. Above that temperature the converter operated in the unignited mode, with partial space-charge neutralization by surface ionization of cesium. It was found that collisionless and diffusion mode theories could be extended into the regime of maximum output power for the unignited mode (spacing and electron mean-free path about equal) to give good agreement with the experimental data. The Knudsen-mode thermionic converter with a structured emitter was also investigated. Analysis has shown that associative ionization between barium and cesium is unlikely to be the cause of the current enhancement observed in previously published work. An analysis which considered the trapping of positive ions in the emitter slots has given good qualitative agreement with published data. Work is continuing on this analysis. Parts for a structured emitter variable spacing converter have been constructed and are being assembled. GRA

N86-13832# Westinghouse Electric Corp., Lima, Ohio. Electrical Systems Div.
TWO-HUNDRED TO 300 KVA CONDITIONED POWER SYSTEM - DEVELOPMENT, PHASE 1 Final Report, Sep. 1982 - Mar. 1984
W. E. Hyvarinen Mar. 1985 409 p
(Contract F33615-82-C-2234)
(AD-A158820; Rept-1383R; AFWAL-TR-84-2065) Avail: NTIS HC A18/MF A01 CSCL 10/2

Future large AF electrical generator channels will be required to operate in parallel to supply single large loads. These channels will be required to use a minimum number of conversion stages to maintain the highest possible efficiency. The EW or other large loads will use power converted directly from the variable speed generator, and only that power required to be 400-Hz will be converted by the V.S.C.F. unit. Redundancy for one generator out condition will be required. The protection and control of the parallel bus will require more sophistication and complexity than the systems presently available. Large rating generators, contactors, and distribution systems will require design effort and test. This report covers a design study to meet the requirements of advanced high power EW systems for aircraft. This report covers the design of a 50 kVA, six-phase generator which is spray oil cooled. The output ratings are 60 kVA at 53% speed, 120 kVA at 60% speed and 410 kVA above 83% speed. The generator maximum design speed is 15,000 rpm. GRA

N86-13833# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
WIND LOADING ON SOLAR COLLECTORS
S. Bhaduri and L. M. Murphy Jun. 1985 49 p
(Contract DE-AC02-83CH-10093)
(DE85-012151; SERI/TR-253-2169) Avail: NTIS HC A03/MF A01

The present design methodology for the determination of wind loading on the various solar collectors were reviewed and assessed. The total force coefficients of flat plates of aspect ratios 1.0 and 3.0, respectively, at various angles of attack obtained by using the guidelines of the ANSI A58.1-1982, were compared with those obtained by using the methodology of the ASCE Task Committee,

1961, and the experimental results of the full-scale test of heliostats by Peglow. The turbulent energy spectra, currently employed in the building code, are compared with those of Kaimal et al., Lumley, and Ponofsky for wind velocities of 20.0 m/s and 40.24 m/s at an elevation of 9.15 m. The longitudinal spectra of the building code overestimates the Kaimal spectra in the frequency range of 0.007 Hz to 0.08 Hz and underestimates beyond the frequency of 0.08 Hz. The peak angles of attack, on the heliostat, stowed in horizontal position, due to turbulent vertical and lateral components of wind velocity, were estimated by using Daniel's methodology for three wind velocities and compared with the value suggested by the code. The experimental results of a simple test in the laboratory indicate the feasibility of decreasing the drag forces of the flat plate by reducing the solidity ratio. DOE

N86-13834# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

REVIEW OF SERI SOLAR POND WORK

F. Zangrando and D. H. Johnson Jul. 1985 53 p

(Contract DE-AC02-83CH-10093)

(DE85-012162; SERI/TR-252-2322) Avail: NTIS HC A04/MF A01

This report provides documentation of SERI's solar pond research effort, which began in 1979. The SERI staff analyzed solar pond topics from modeling and feasibility studies to laboratory experiments on physical properties and hydrodynamical stability. The SERI's perspective on the maturity of this solar technology is described, including the technical state-of-the-art of salt-gradient solar ponds, state of knowledge of pond design, estimated cost ranges for various locations and applications, and perceived barriers to commercial development. Recommendations for future work are also presented. The SERI research and development on solar ponds is described, emphasizing analytical and experimental tools developed at SERI. All AERI and subcontract reports dealing with solar ponds or related system components are summarized, and a bibliography is provided. DOE

N86-13835# Purdue Univ., West Lafayette, Ind. School of Mechanical Engineering.

PERFORMANCE ASSESSMENT OF OTEC POWER SYSTEMS AND THERMAL POWER PLANTS. VOLUME 2: USERS MANUAL FOR PACC-OTECS Final Report

W. Leidenfrost, P. E. Liley, A. T. McDonald, I. Mudawwar, and J. T. Pearson May 1985 76 p Prepared in cooperation with Argonne National Lab., Idaho Falls, Idaho

(Contracts DE-AC03-76SF-00700; DE-AC01-82CD-30718)

(DE85-016792; DOE/SF-00700/T11-Vol-2) Avail: NTIS HC A05/MF A01

A user's manual for an interactive computer program that can calculate the simulated performance of closed cycle ocean thermal energy conversion (OTEC) power systems is presented. The program was developed for use on the IBM personal computer. The program calculate the thermodynamic properties of the working fluids (ammonia and seawater). This manual specifies the power system flow configuration, the input data requirements, and the results calculated by the program. The geometry of the heat exchangers is also described. A listing of the computer program is included. DOE

N86-13836# Argonne National Lab., Ill.

FAR-FIELD MODEL OF THE REGIONAL INFLUENCE OF AFFLUENT PLUMES FROM OCEAN THERMAL ENERGY CONVERSION (OTEC) PLANTS

D. P. Wang Jul. 1985 39 p

(Contract W-31-109-eng-38)

(DE85-016981; ANL/OTEC-EV-3) Avail: NTIS HC A03/MF A01

Ocean thermal energy conversion (OTEC) plants discharge large volumes of cold water into the upper ocean. A three-dimensional, limited-area model was developed to investigate the regional influence of the far-field effluent plume created by the negatively buoyant discharge. The model was applied to discharges from a 40-MW sub e OTEC plant into coastal waters characterized by various ambient ocean conditions. A typical ambient temperature structure and nutrient distribution, as well as the behavior of the effluent plume itself, were strongly modified by the discharge-induced circulation. Although temperature perturbations in the plume were small, upward entrainment of nutrients from below the thermocline was significant. The regional influence of discharges from an 80-MW sub e OTEC plant, the interactions between the discharges from two adjacent 40-MW sub e OTEC plants, and the effects of coastal boundary and bottom discharge were examined with respect to the regional influence of a 40-MW sub e OTEC plant located in deep water off a coast (base case). DOE

N86-13837# Delaware Univ., Newark. Inst. of Energy Conversion.

DEVELOPMENT OF STABLE HIGH EFFICIENCY POLYCRYSTALLINE THIN-FILM SOLAR CELLS BASED ON CuInSe2 Final Report, 16 Mar. 1983 - 15 Mar. 1984

R. W. Birkmire, R. B. Hall, J. E. Phillips, and J. D. Meakin Mar. 1985 300 p

(Contract DE-AC02-83CH-10098)

(DE85-000517; SERI/STR-211-2516) Avail: NTIS HC A13/MF A01

A two-junction, monolithic, optically and electrically coupled solar cell has been designed and a successful prototype produced. Each junction is a thin-film polycrystalline cell, namely, CuInSe2 (CdZn)S and CdTe (CdZn)S. All active semiconductor layers are produced by physical vapor deposition. During this contract year, a procedure for producing thin-film p-type CdTe by physical vapor deposition and a usable transparent interconnect for the tandem cell were developed. DOE

N86-13838*# Wilkes Coll., Wilkes-Barre, Pa.

ELECTRICAL RESEARCH ON SOLAR CELLS AND PHOTOVOLTAIC MATERIALS Final Report

J. Orehotsky 5 Mar. 1985 208 p

(Contract NAS7-918)

(NASA-CR-176384; DOE/JPL-956766-85/01; NAS 1.26:176384; DE85-016575) Avail: NTIS HC A10/MF A01 CSCL 10A

A systematic study of the properties of various polymer pottant materials and of the electrochemical corrosion mechanisms in solar cell materials is required for advancing the technology of terrestrial photovoltaic modules. The items of specific concern in this sponsored research activity involve: (1) kinetics of plasticizer loss in PVB, (2) kinetics of water absorption and desorption in PVB, (3) kinetics of water absorption and desorption in EVA, (4) the electrical properties at PVB as a function of temperature and humidity, (5) the electrical properties of EVA as a function of temperature and humidity, (6) solar cell corrosion characteristics, (7) water absorption effects in PVB and EVA, and (8) ion implantation and radiation effects in PVB and EVA. DOE

N86-13839# New Mexico Inst. of Mining and Technology, Socorro. Dept. of Metallurgical and Materials Engineering.

MICROSTRUCTURAL AND MECHANICAL PROPERTY EVALUATION OF SOLAR COLLECTORS Final Report

O. T. Inal 1 Jun. 1985 23 p

(Contract DE-AS04-78AL-04266)

(DE85-017038; DOE/AL-04266/T2) Avail: NTIS HC A02/MF A01

The overall contributions of the program can be divided into three major areas: (1) nucleation and growth studies of adatom layers through transmission electron microscopy, reflection electron diffraction, and field-ion microscopy techniques; (2) electrodeposition parameter optimization studies for the production of photothermal collector surfaces made in terms of the as plated as well as thermally degraded microstructures; and (3) the thermal degradation mechanisms that emanate from structural alterations were optically modelled for the coatings produced in (2). These three topics are individually summarized. DOE

N86-13840# Studsvik Energiteknik A.B., Nykoping (Sweden).

SMALL SOLAR POWER SYSTEMS PLANT IN ALMERIA SYSTEM EVALUATION AND COMPARISON ON THERMAL BASIS

Final Report
J. Sandgren and M. Andersson 1985 179 p Prepared in cooperation with Theorells Ingenjoersbyra AB, Solna, Sweden
(Contract DE-AC04-76DR-00789)
(DE85-017185; DOE/DR-00789/T13) Avail: NTIS HC A09/MF A01

The International Energy Agency's Small Solar Power Systems (IEA/SSPS) thermo-electric power plant in Almeria, Spain, consists of a distributed collector system (DCS) with three fields and a central receiver system (CRS). During the period of September 1983 to August 1984, the DCS-ACUREX field produced a daily average of 1.13 kWh/sq m. thermal energy from an average direct irradiation onto a field aperture of 4.48 kWh/sq m, and the DCS-MAN field 1.04 kWh/sq m from 5.91 kWh/sq m irradiated energy. In the Spring of 1984, an improved MAN field was put into operation and showed a considerable improvement compared to the original field. It produced 1.88 kWh/sq m thermal energy from 6.96 kWh/sq m daily mean beam irradiation. The CRS plant was proved to be capable of producing twice as much thermal energy per sq m reflector area as the ACUREX field, and it is pointed out that for further development of high temperature applications it has greater opportunities than DCS fields. For solar thermo-electrical power generation, it is necessary to develop more compact thermo-electrical power conversion systems. Of existing engines, Stirling units show potential for adaptation to CRS plants. DOE

N86-13841# Idaho Dept. of Water Resources, Boise.
GEOTHERMAL INVESTIGATION IN IDAHO. PART 14: GEOCHEMICAL AND ISOTOPIC INVESTIGATIONS OF THERMAL WATER OCCURRENCES OF THE BOISE FRONT AREA, ADA COUNTY, IDAHO, WATER INFORMATION BULLETIN NO. 30
A. L. Mayo, A. B. Muller, and J. C. Mitchell Dec. 1984 60 p refs
(Contract DE-AS07-77ET-28407)
(DE85-012905; DOE/ET-28407/T5-Pt-14) Avail: NTIS HC A04/MF A01

A limited chemical and isotopic investigation was undertaken and geological, geophysical, and hydrological data in the literature were reviewed to evaluate the geothermal potential of the Poise area. DOE

N86-13842# Oak Ridge Gaseous Diffusion Plant, Tenn.
FIRST ORDER ESTIMATES OF THE DYNAMICS AND ENERGETICS OF A RAPIDLY DECELERATING FLYWHEEL
G. T. Gillies Jun. 1985 22 p
(Contract DE-AC05-84CT-21400)
(DE85-013908; K/TS-5867) Avail: NTIS HC A02/MF A01

Martin Marietta Energy Systems, Inc., is developing advanced inertial energy storage devices (flywheels) for use in the University of Texas/DARPA homopolar generator. Several order of magnitude estimates for a variety of calculable quantities pertinent to the design of such a flywheel are presented. These include the mass, moment of inertia, and kinetic energy of the rotor. In addition, the equivalent rotor braking torque, peripheral deceleration, and centripedal accelerations are found, along with the braking force and total rotor angular momentum. Next, the differential equation of the rotor is solved in both the general and a particular case, and the Euler-type rigid body equation of motion is considered. Finally, various thermal and electrical effects are studied and the behavior of unbalance forces are examined. DOE

N86-14102*# Prairie View Agricultural and Mechanical Coll., Tex.
SOLAR CONCENTRATOR DEGRADATION IN LOW EARTH ORBIT (LEO) Final Report
Richard G. Thomas *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 12 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-13843# Wright State Univ., Dayton, Ohio. Dept. of Chemistry.
AQUATIC PLANT CONTROL RESEARCH PROGRAM: EVALUATION OF POLYMERS FOR CONTROLLED DELIVERY OF HERBICIDES FOR AQUATIC PLANT CONTROL Final Report
F. W. Harris Jun. 1985 95 p
(Contract DACW39-76-C-0016)
(AD-A157948; WES/TR/A-85-2) Avail: NTIS HC A05/MF A01 CSCL 06/6

This work was conducted to develop and evaluate new polymer compounds containing pendant herbicide substituents with the ultimate purpose of producing effective, economical, and environmentally safe controlled release aquatic herbicides. The synthesis of one of the most promising controlled-release systems prepared and evaluated in this study, i.e., an hydroxy-terminated, low-molecular-weight 2,4-D/Poly GMA adduct, was successively scaled-up to commercial levels. However, the processing of the adduct solution as obtained from the reaction mixture was difficult. A method must be developed to remove the solvent before the procedure can be used to prepare material for field tests. GRA

N86-13844# Brookhaven National Lab., Upton, N. Y.
OXIDIZING AND SCAVENGING CHARACTERISTICS OF APRIL RAINS: OSCAR DATA REPORT
C. M. Benkovitz, V. A. Evans, J. L. Tichler, J. V. Hayes, and K. J. Norden Oct. 1984 245 p
(Contract DE-AC02-76CH-00016)
(DE85-017014; BNL-51881) Avail: NTIS HC A11/MF A01

The organization of this report is as follows: Chapter 1 presents a description of the OSCAR experiment, including its objectives, design, and field deployment. Chapter 2 presents the OSCAR Central Data Coordination function and summarizes the tasks needed to compile each data set. Chapters 3 through 6 address each of the four OSCAR events. A synoptic description of each event is presented in these chapters, followed by a summary of the data captured during the event. Chapter 3 and Appendices C-G then present detailed tabular and graphical displays of the data captured during this event by the intermediate-density precipitation chemistry network, the BNL aircraft and by state/province agency networks. Data form the high-density precipitation chemistry network are being presented in a separate series of reports by Pacific Northwest Laboratory. Detailed displays of the data for events 2 to 4 have not been included in this report; however, selected portions could be developed for interested parties. DOE

N86-13845# Oak Ridge National Lab., Tenn.
CHANGES IN SOIL ACIDITY DUE TO NATURAL PROCESSES AND ACID DEPOSITION
D. W. Johnson 1985 22 p Presented at the NATO ARW Conf. on Effects of Acidic Deposition on Forests, Wetlands and Agr. Ecosystems, Toronto, 12 May 1985
(Contract DE-AC05-84OR-21400)
(DE85-012103; CONF-8505156-1) Avail: NTIS HC A02/MF A01

It is now generally accepted that, in extremely acid soils, soil solution acidity can change rapidly in response to inputs of sulfate due to the salt effect. There is little evidence of rapid change in bulk soil acidity due to acid deposition, however, except in cases where acid inputs are extremely high. Over periods of many decades, soil acidity can be increased due to tree uptake of base cations, humus formation, and natural as well as acid-deposition-enhanced soil leaching. The role of acid deposition in accelerating soil acidification rates can be estimated from elemental budget approaches, but the actual changes in soil acidity due to acid deposition are difficult to document because so few studies combine the measurement of element and proton fluxes with long-term periodic remeasurements of soil acidity. Most empirical observations to date show little change in forest soil acidity from

any cause in less than 20 to 30 years. However, some increases in exchangeable or soluble Al3+ without concomitant reductions in exchangeable base cations have been noted at the Solling site in West Germany. These Al3+ releases may be due to dissolution of interlayer Al3+ in 2:1 clays. All attempts to monitor long-term changes in soil acidity should take into account the possibility of seasonal variations due to annual cycling of base-cations by vegetation. The effects of seasonal uptake and return of base cations by vetetation upon the base cation status of surface soils can be considerable and might be confused with long-term trends if not properly accounted for. DOE

N86-13846# California Dept. of Health Services, Berkeley. Industrial Hygiene Lab. Section.
PARTICULATE MATTER ANALYSIS BY ELECTRON MICROSCOPY Final Report
S. B. Hayward, W. John, L. Webber, and J. J. Wesolowski Dec. 1984 71 p
(Contract ARB-A2-058-32)
(PB85-227817; CA/DOH/AIHL/SP-33; ARB-R-85/250) Avail: NTIS HC A04/MF A01 CSCL 06F

The AIHL/CARB Center for Automated Particle Analysis (CAPA) has been established for the development of airborne particle source apportionment techniques. An automated scanning electron microscope with energy-dispersive X-ray analysis is used to characterize individual particles based on their morphological and chemical characteristics. During the initial phase of development at CAPA, sampling and analytical hardware was optimized. Preliminary steps in software development centered around data transfer and spectral processing, coupled with conceptual development of Distribution Analysis, which will ultimately be used for source apportionment. Sampling and analysis techniques were tested on a simple system: bulk source and upwind and downwind ambient air samples from a cement plant on the California coast. Author (GRA)

N86-13847# Southern Research Inst., Birmingham, Ala.
PROTOCOL FOR SIZE-SPECIFIC EMISSION MEASUREMENTS (SIM-5) APPLIED TO PM(10) Final Report
W. E. Farthing, J. D. MCCain, A. D. Williamson, and T. E. Ward 1985 21 p refs
(Contract EPA-68-02-3696)
(PB85-200194; EPA-600/D-85-109) Avail: NTIS HC A02/MF A01 CSCL 14B

Aerosol particles can be with drawn from industrial process streams and separated into two or more aerodynamic size fractions with a commercially available inertial impactor or cyclone. However, with this currently-available equipment, the process gas must be sampled at a constant flow rate to provide constant size cut(s). Thus, traversing of a duct in one sampling run while maintaining isokinetic flow rate as in EPA Reference Methods 5 or 17, cannot be performed, because the flow rate cannot be adjusted from point to point to mach stream and sampling nozzle velocities. Sampling theory was analyzed to develop a protocol for existing hardware which limits anisokinetic sampling error to acceptable levels, requires traversing, and is practical enough for source sampling. Anisokinetic sampling error was characterized for aerosol size distributions measured at sources and for hypothetical distributions. A protocol was developed and tested in which net sampling error is always less than 13% even, if anisokinetic error is 20%. GRA

N86-13848# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
CHARACTERIZATION OF ACID RAIN PHENOMENA, ATLANTA, GEORGIA
K. C. Beck Aug. 1984 51 p refs
(PB85-216943; ERC-04-84; USGS/G-836(03)) Avail: NTIS HC A04/MF A01 CSCL 08H

Rain collection and chemical analysis for pH, Na, K, Mg, Ca, NH4, Cl, NO3 and SO4 was initiated at an urban Atlanta site in August 1983 and is continuing on an event and subevent basis. Additional collecting began at Suburban Stone Mountain in June 1984. Current data do not indicate significant urban-suburban-rural differences in composition for the species studied. Subepisode sampling indicates minor and irregular changes in composition during frontal system rains, but during local rains, particularly intense events following extended dry periods during late spring and summer, there are marked decreases with time in the concentrations of all species except H(+). Stream observations at Stone Mountain provide no evidence for major early regolith modification of rain, other than SO4 removal, but evaporation in a complex path from rock outcrop to stream and possible stream pollution complicate interpretation. Author (GRA)

N86-13849# California Dept. of Health Services, Berkeley. Air and Industrial Hygiene Lab. Section.
DETERMINATION OF ACIDITY IN AMBIENT AIR Final Report
B. R. Appel, Y. Tokiwa, V. Povard, and E. L. Kothny Dec. 1984 87 p
(Contract Arb-A1-159-32)
(PB85-218196; ARB-R-85/243) Avail: NTIS HC A05/MF A01 CSCL 14B

A laboratory and field study was performed to construct and evaluate an automated, semi-continuous monitor for ambient air concentrations of nitric acid (HNO3) and ammonia (NH3) utilizing tungstic acid-coated denuder tubes. In addition, atmospheric concentrations of hydrochloric acid (HCl) were determined. Manual techniques for atmospheric NH3 measurement were also compared. Atmospheric sampling for HNO3 was done in Riverside, CA during September 1984 with the automated tungstic acid technique (TAT), and by the denuder difference method (DDM). Author

N86-13785# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF PETROLEUM POLLUTION ON OCEAN-ATMOSPHERE GAS EXCHANGE INTENSITY (IN EXAMPLE OF NORTH ATLANTIC) Abstract Only
V. V. Alekseyev, P. A. Baranov, A. O. Kokorin, and V. M. Sheremetyev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 33 Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz., Astron. (Moscow), v. 26, no. 3, May - Jun. 1985 p 71-74 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-13850*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRBORNE LIDAR MEASUREMENTS OF EL CHICHON STRATOSPHERIC AEROSOLS
M. Patrick McCormick and M. T. Osborn (SASC Technologies, Inc., Hampton, Va.) Oct. 1985 89 p refs
(NASA-RP-1148; L-16007; NAS 1.61:1148) Avail: NTIS HC A05/MF A01 CSCL 04A

A NASA Electra airplane, outfitted with a lidar system, was flown in January to February 1983 between the latitudes of 27 deg N and 76 deg N. One of the primary purposes of this mission was to determine the spatial distribution and aerosol characteristics of the El Chichon-produced stratospheric material. This report presents the lidar data from that flight mission. Representative profiles of lidar backscatter ratio, plots of the integrated backscattering function versus latitude, and contours of backscatter mixing ratio versus altitude and latitude are given. It addition, tables containing numerical values of the backscatter ratio and backscattering function versus altitude are supplied for each profile. The largest amount of material produced by the El Chichon eruptions of late March to early April 1982, which was measured by this flight, resided between 35 deg N and 52 deg N. Peak backscatter

ratios at a wavelength of 0.6943 micro m decreased from 8 to 10 at the lower latitudes to 3 at the higher latitudes. Backscatter ratio profiles taken while crossing the polar vortex show that the high-altitude material from El Chichon arrived at the north polar region sometime after the winter polar vortex was established. This report presents the results of this mission in a ready-to-use format for atmospheric and climatic studies. Author

N86-13851*# Augsburg Coll., Minneapolis, Minn.
ANALYSIS OF ATOMIC THERMOSPHERIC NITROGEN DENSITY Final Technical Report, 1 Jul. 1983 - 15 Sep. 1985
Mark J. Engebretson [1985] 14 p
(Grant NAG5-349)
(NASA-CR-176354; NAS 1.26:176354) Avail: NTIS HC A02/MF A01 CSCL 04A

A NASA grant provided support for a research project at Augsbury College, Minneapolis, Minnesota for the analysis of atomic nitrogen density data obtained by the Neutral Atmospheric Composition Spectrometer (NACS) on board the Dynamics Explorer-2 satellite. Initial funding was for an exploratory study of the feasibility of obtaining ambient densities of N from source densities of NO. Funding was continued under the Dynamics Explorer Guest Investigator Program when initial studies indicated probable success in obtaining such ambient densities. The major scientific focus of the later work was to be to characterize the behavior of N densities at high latitudes. Author

N86-13852*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF STORM TIME FLUXES OF HEAVY IONS Final Report, 20 May 1980 - 19 Nov. 1985
R. D. Sharp and J. M. Quinn Nov. 1985 26 p
(Contract NASw-3395)
(NASA-CR-176368; NAS 1.26:176368) Avail: NTIS HC A03/MF A01 CSCL 04A

Ion composition data sets from Lockheed instruments on a variety of spacecraft were used in combination with each other and with data from other instruments to address a variety of problems regarding plasma sources, energization and transport within the magnetosphere. The availability of data from several differing orbits has given a highly flexible approach to attacking the continually evolving questions of magnetospheric physics. This approach is very successful and should be continued in the future. E.A.K.

N86-13853# Bedford Research Associates, Mass.
IE DATA PROCESSING
P. Meehan Oct. 1984 65 p
(Contract F19628-82-C-0139)
(AD-A158027; AFGL-TR-85-0007; SR-1) Avail: NTIS HC A04/MF A01 CSCL 04/1

Two satellites are generating and have been generating SSIE (Topside ionosphere plasma monitor) data for several years. Because of the large volume of information (approx. 180 bits/second per satellite) and noise contained in it, a computer software system has been developed at AFGL to handle the data and make it available for in-house use. The intent is to allow AFGL personnel various desired window looks at the data through graphics, listings or data downloading. The building of the SSIE database is an on-going process and new application packages are added as needed. GRA

N86-13854# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
THE VAIONT SLIDE. A GEOTECHNICAL ANALYSIS BASED ON NEW GEOLOGIC OBSERVATIONS OF THE FAILURE SURFACE. VOLUME 1: MAIN TEXT Final Report
A. J. Hendron, Jr. and F. D. Patton Jun. 1985 257 p
(AD-A158192; WES/TR/GL-85-5-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 08/7

The study confirmed that the Vaiont Slide was a reactivation of an old slide. The slide moved upon one or more clay layers which were continuous over large areas of the surface of sliding. Three-dimensional stability analyses were required due to the magnitude of the upstream inclination of the clay layers forming the base of the slide. The angle of shearing resistance of the clay layers was determined to be about 12 degrees. The fluid pressure distributions used were consistent with the only piezometric data available before the 1963 slide and with an interpretation of the local groundwater flow system including the presence of karstic terrain above the slide. Results of the analyses completed for key periods in the history of the slide agree with the known slide behavior during these periods. The results also indicate that the reduction in the factor of safety caused by reservoir filling alone was approximately 12 percent, while the reduction caused by rainfall or snowmelt ranged from 10 to 18 percent. Correlations made between cumulative precipitation, reservoir levels, and slide movement records provide a well-defined failure envelope. These results explain why the slide was unstable at a given reservoir level and later stable at the same level. Conclusions from these correlations are consistent with the results of the stability analyses. The results of the study also suggest that the slide could have been stabilized by drainage. GRA

N86-13855# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
THE VAIONT SLIDE. A GEOTECHNICAL ANALYSIS BASED ON NEW GEOLOGIC OBSERVATIONS OF THE FAILURE SURFACE. VOLUME 2: APPENDICES A THROUGH G Final Report
A. J. Hendron, Jr. and F. D. Patton Jun. 1985 117 p
(AD-A158193; WES/TR/GL-85-5-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 08/7

A geotechnical analysis of the failure surface of the Vaiont Slide is given. Precipitation records from 1960 to 1963; the static slope analysis method used for the vaiont slide analyses; sections used in stability analyses; three-dimensional slope stability calculations; calculation of slide velocities; heat generated pore pressure mechanisms; and a summary of geological studies on the slide at vaiont, 1959 to 1964 are discussed. GRA

N86-13856# National Bureau of Standards, Gaithersburg, Md. Quantum Chemistry Group.
APPLICATION OF QUANTUM CHEMISTRY TO ATMOSPHERIC CHEMISTRY Final Report, 1 Oct. 1983 - 30 Sep. 1984
M. Krauss and W. J. Stevens 30 Sep. 1984 118 p
(Grant AF-AFOSR-ISSA-84-0000)
(AD-A158282; AFOSR-85-0563TR) Avail: NTIS HC A06/MF A01 CSCL 07/4

Analysis of the accuracy of the experimentally deduced dissociation energies of refractory metal salts requires a knowledge of the electronic structure of the molecules. Relativistic effective potentials (REP) have now made such calculations for metal containing molecules possible. The present report will describe our tests and applications of the effective potential method. We have just completed a review of the use of effective potentials in molecular quantum chemistry. The review is given in Section 2. In Section 3 the abstract is given for the paper on Relativistic Effective Potential SCF Calculations of AgH and AuH, which has been accepted by the Journal of Computational Chemistry. The preprint for the analysis of the Electronic Structure of FeO and RuO is given in Section 4. Analysis of the orbital structure establishes the basis for an aufbau for the ground state of all the transition metal oxides in the first two rows. Preliminary results were reported for NdO+, NdO, and UO in last years report but a new set of CEP are now being developed for the lanthanides and actinides. This is a preliminary to a study of other lanthanide oxides and to polyatomic systems using the CEP. The abstract for the paper Compact Effective Potentials and Efficient Shared-Exponent Basis Sets for the First- and Second-Row Atoms is given in Section 5. Application to the analysis of the spectra of Al2 is described in the abstract for the paper Electronic State of Al2. GRA

N86-13857# Pittsburgh Univ., Pa. Dept. of Chemistry.
MEASUREMENT OF RATE CONSTANTS OF ELEMENTARY GAS REACTIONS OF IMPORTANCE TO UPPER ATMOSPHERE AND

COMBUSTION SYSTEMS Final Technical Report, 1 Sep. 1980 - 28 Feb. 1985
F. Kaufman 10 May 1985 11 p
(Grant AF-AFOSR-0207-80)
(AD-A158824; SQ08671-84-00661; AFOSR-85-0503TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The vibrational energy transfer of highly excited HCl and HF was studied by the infrared chemiluminescence method in a series of five papers. HCl(v < or = 7) and HF(v < or = 7) were produced by fast generating reations, e.g., H + IC1 yields (v < or = 7) + I or H +F2 yields (< or = 7) + F in large excess He which relaxes the rotational but not the vibrational excitation. With various added quencher gases, about 200 rate constants for stepwise vibrational energy transfer were measured. They tend to increase rapidly with increasing v, often independent of the vibrational energy defect. For HF (v) + HF (O), self-relaxation, the V-V channel decreases from 55% at v=2 to zero at v > 5 even though the relaxation rate constant rises as v to the 2.7 power. A versatile flow reactor system was built that features three detection methods (laser-induced fluorescence, vacuum u.v. resonance fluorescence, and modulated molecular beam mass spectrometry) plus upstream radical production by IR laser multiphoton decomposition. The NH2 + NO and CH3O + NO2 reactions were studied successfully. The latter was found to have a recombination (CH3ONO2) and disproportionation (CH2O + HNO2) channel and both were measured indirectly. The 18O + NO or O2 isotope exchange reactions were measured, and the results compared with measured and calculated high-pressure limits of the respective recombinations and with NO vibrational relaxation. GRA

N86-13858# Woodard-Clyde Consultants, San Francisco, Calif.
GEOLOGIC CHARACTERIZATION REPORT FOR THE PARADOX BASIN STUDY REGION, UTAH STUDY AREAS. VOLUME 6: SALT VALLEY
Dec. 1984 221 p refs
(Contract DE-AC02-83CH-10140)
(DE85-011699; ONWI-290-Vol-6) Avail: NTIS HC A10/MF A01

Surface landforms in the Salt Valley Area are generally a function of the Salt Valley anticline and are characterized by parallel and subparallel cuestaform ridges and hogbacks and flat valley floors. The most prominent structure in the Area is the Salt Valley anticline. Erosion resulting from the Tertiary uplift of the Colorado Plateau led to salt dissolution and subsequent collapse along the crest of the anticline. Continued erosion removed the collapse material, forming an axial valley along the crest of the anticline. Paleozoic rocks beneath the salt bearing Paradox Formation consist of limestone, dolomite, sandstone, siltstone and shale. The salt beds of the Paradox formation occur in distinct cycles separated by an interbed sequence of anhydrite, carbonate, and clastic rocks. The Paradox Formation is overlain by Pennsylvanian limestone; Permian sandstone; and Mesozoic sandstone, mudstone, conglomerate and shale. No earthquakes have been reported in the area during the period of the historic record and contemporary seismicity appears to be diffusely distributed, of low level and small magnitude. The upper unit includes the Permian strata and upper Honaker trail formation. DOE

N86-13859# Lawrence Livermore National Lab., Calif.
INVERSION OF RAYLEIGH WAVE PHASE VELOCITIES BETWEEN RSNT AND RSON
G. E. Randall and S. R. Taylor 29 Nov. 1985 19 p refs
(Contract W-7405-eng-48)
(DE85-013242; UCID-20504) Avail: NTIS HC A02/MF A01

Rayleigh wave phase velocities in the Canadian Shield are estimated for the path between RSNT and RSON in the period range of 10 to 100 sec. Frequency dependent stacking techniques are employed to form an estimate of phase velocity from a limited data set of marginal quality. Inversion of the phase velocities for shear velocity structure indicates an average crustal thickness of 40 km which is consistent with results from previous studies. The lower crustal velocities from our study appear to be slightly greater than those from other studies and Sn velocities along the path are about 4.7 km/s. The effectiveness of the frequency dependent stacking techniques confirms the assumption of signal-independent background noise dominating the records for periods less than about 30 sec and signal-dependent multipathing noise dominating for periods longer than about 40 sec. DOE

N86-13860# Los Alamos National Lab., N. Mex.
CHARACTERISTICS OF MICROEARTHQUAKES ACCOMPANYING HYDRAULIC FRACTURING AS DETERMINED FROM STUDIES OF SPECTRA OF SEISMIC WAVEFORMS
M. Fehler and D. Bame Mar. 1985 7 p refs Presented at the Intern. Symp. on Geothermal Energy, Kailua Kona, Hawaii, 26 aug. 1985
(Contract W-7405-eng-36)
(DE85-009558; LA-UR-85-930; CONF-850801-12) Avail: NTIS HC A02/MF A01

A study of the spectral properties of the waveforms recorded during hydraulic fracturing earthquakes has been carried out to obtain information about the physical dimensions of the earthquakes. We find two types of events. The first type has waveforms with clear P and S arrivals and spectra that are very similar to earthquakes occurring in tectonic regions. These events are interpreted as being due to shear slip along fault planes. The second type of event has waveforms that are similar in many ways to long period earthquakes observed at volcanoes and is called long period. Many waveforms of these events are identical, which implies that these events represent repeated activation of a given source. We propose that the source of these long period events is the sudden opening of a channel that connects two cracks filled with fluid at different pressures. The sizes of the two cracks differ, which causes two or more peaks to appear in the spectra, each peak being associated with one physical dimension of the crack. From the frequencies at which spectral peaks occur, we estimate crack dimensions of between 3 and 22m. DOE

N86-13861# Joint Publications Research Service, Arlington, Va.
USSR REPORT: ENERGY
14 Jan. 1985 156 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UEN-85-001) Avail: NTIS HC A08

Progress in energy technology and exploration is reported. Topics discussed include: oil, gas, and coal resources, and energy conservation. For individual titles, see N86-13862 through N86-13864.

N86-13862# Joint Publications Research Service, Arlington, Va.
AZERBAIJAN GEOLOGICAL, GEOPHYSICAL WORK ON LAND DESCRIBED
A. N. Guseynov, A. M. Akhmedov, S. G. Nadirov, and Sh. S. Kocharli *In its* USSR Rept.: Energy (JPRS-UEN-85-001) 14 Jan. 1985 p 1-11 Transl. into ENGLISH of Zerbaydzhanskoye Neftyanoye Khozyaysto (Baku, USSR), no. 6, Jun. 1984 p 1-6
(For primary document see N86-13861 04-46)
Avail: NTIS HC A08

In 1981 to 1983 two oilfields were discovered--The Zardob with three deposits and the Tarsdallyar, with a deposit in the Middle Eocene. The Zardob and Tarsdallyar were prepared for deep drilling by geophysical methods. The Zardob area is located to the northwest of the Muradkhanly field and has a geological structure similar to it. The Tarsdallyar field, a firstling in the interriverine area, is in the southeastern part of the Dzheyranchel synclinorium. It is found that the 16th horizon of the PT [productive series] at the Kyurovdag field is oil-bearing, and the presence of oil is confirmed for the PT's 4th horizon in the axial portion of the northwestern submergence and for the PT's 8th horizon to the southeast of the fold's pericline. E.A.K.

N86-13863# Joint Publications Research Service, Arlington, Va.
POSSIBLE PETROLIFEROUSNESS OF SOUTH CASPIAN UPLIFTS ANALYZED
M. N. Asadov, Sh. A. Azizova, and A. A. Narimanov *In its* USSR Rept.: Energy (JPRS-UEN-85-001) 14 Jan. 1985 p 12-17 refs Transl. into ENGLISH from Azerbaydzhanskoye Neftyanoye

Khozyaystvo (Baku, USSR), no. 6, Jun. 1984 p 7-10 (For primary document see N86-13861 04-46)
Avail: NTIS HC A08

In the Apsheron-Balkhan uplift zone, the Middle Pliocene is represented by Apsheron and Turkmen types of lithofacies, each of which has its own characteristic features. They are distinguished by different compositions and associations of their rock components, which are caused primarily by the presence of different sources that feed the province; the suppliers of terrigenic material to the sedimentation basin. The lithofacies factor is one of the basic criteria in the search for oil and gas, and plays an important role in determining the degree of promise of various areas and of various complexes of sediments. The study of the material content of the types of lithofacies and making comparisons between them is of interest when choosing areas for prospecting and exploration of oil and gas. The structures of the Middle Pliocene were studied. The redbed series (KT) of the Middle Pliocene is divided into separate horizons. Below lie sediments are called the underlying series (PKT). The description of the lithological and petrographic characteristics is not considered correct for the individual horizons but for the KT and PKT cross-sections as a whole it is accurate.
E.A.K.

N86-13864# Joint Publications Research Service, Arlington, Va.
TECTONIC STRESS ON STRUCTURES ALTERS FORMATION PARAMETERS
N. Ter-Karapetyants *In its* USSR Rept.: Energy (JPRS-UEN-85-001) 14 Jan. 1985 p 18-22 Trans. into ENGLISH from Zerbaydzhanskoye Neftyanoye Khozyaystvo (Baku, USSR), no. 6, p 10-14 (For primary document see N86-13861 04-46)
Avail: NTIS HC A08

Changes in values of open porosity, permeability and temperature on the regional scale that are connected with stress on the structure that is caused by tectonic forces was studied. It was established that under overthrusting conditions, azimuthal change in direction of a formation's strike and increase in the formation's dip angle. Parameters were compared by area and by adjacent field.
E.A.K.

N86-13767# Joint Publications Research Service, Arlington, Va.
MODEL INTERPRETATION OF ANNUAL VARIATION OF TEMPERATURE FIELDS OF AIR AND WATER BOUNDARY LAYERS OF WORLD OCEAN Abstract Only
A. Ye. Rozhdestvenskiy and M. V. Semenov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 8 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 537-543 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13776# Joint Publications Research Service, Arlington, Va.
FORMATION OF UNDERWATER OCEANIC VOLCANOES AND ISLANDS IN RELATION TO LITHOSPHERIC THICKNESS AND MOVEMENTS Abstract Only
A. M. Gorodnitskiy *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 20 Transl. into ENGLISH from Byul. Mosk. Obshchestva Ispytateley Prirody: Otd. Geol. (Moscow), v. 60, no. 4, Jul. - Aug. 1985 p 24-37 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13780# Joint Publications Research Service, Arlington, Va.
STATISTICAL CORRELATION BETWEEN OZONE LEVELS OVER ATLANTIC OCEAN AND METEOROLOGICAL VALUES Abstract Only
V. M. Bazhanov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 29 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 6, Jun. 1985 p 609-613 Original language document was announced in IAA as A85-44482 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13784# Joint Publications Research Service, Arlington, Va.
ATMOSPHERIC SYNOPTIC EDDIES OVER OCEAN (DETERMINED FROM EXPERIMENTAL DATA) Abstract Only
V. Ye. Lagun and V. F. Romanov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 32 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 474-484 Original language document was announced in IAA as A85-40640 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13787# Joint Publications Research Service, Arlington, Va.
NEW METHODS FOR LASER SOUNDING OF ATMOSPHERE ON BASIS OF NONLINEAR EFFECTS Abstract Only
V. Ye. Zuyev and Yu. D. Kopytin *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 34-35 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 418-427 Original language document was announced in IAA as A85-31852 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13788# Joint Publications Research Service, Arlington, Va.
INTERACTION BETWEEN POWERFUL LASER RADIATION AND ATMOSPHERIC AEROSOLS Abstract Only
M. P. Gordin, Yu. N. Grachev, V. S. Loskutov, V. P. Sadovnikov, A. V. Sokolov, and G. M. Strelkov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 35-36 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 450-458 Original language document was announced in IAA as A85-31856 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13789# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF NONLINEAR SPECTROSCOPIC EFFECTS IN INTERACTION BETWEEN CO2-LASER RADIATION AND ATMOSPHERIC GASES Abstract Only
B. G. Ageyev, Ye. P. Gordov, Yu. N. Ponomarev, and S. D. Tvorogov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 36 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 459-465 Original language document was announced in IAA as A85-31857 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14117# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF FLUXES OF COLD IONS FROM PLASMASPHERE INTO IONOSPHERE DURING NIGHTTIME IN MIDDLE LATITUDES Abstract Only
V. V. Afonin, P. Bentse, V. V. Bezrukikh, K. I. Gringauz, I. Semerei, and N. F. Smirnova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 28 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 884-888 Original language document announced in IAA as A85-19908 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14127# Joint Publications Research Service, Arlington, Va.
MECHANISM OF CORPUSCULAR-ATMOSPHERIC RELATIONSHIPS Abstract Only
E. R. Mustel *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 36-37 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1179-1183 Previously announced in IAA as A85-42341 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14136# Joint Publications Research Service, Arlington, Va.
DISTURBANCES IN STRATOSPHERE AND MESOSPHERE FROM SOURCE OF ULTRAVIOLET RADIATION Abstract Only
S. I. Kozlov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 43 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 712-719 Original language document announced in IAA as A85-15258 (For primary

document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14137# Joint Publications Research Service, Arlington, Va.
COORDINATED INVESTIGATIONS OF PROCESSES IN SUB-AURORAL UPPER IONOSPHERE AND THROUGH IN CONCENTRATION OF LIGHT IONS Abstract Only
L. D. Sivtseva, V. M. Filippov, V. L. Khalipov, Yu. I. Galperin, V. A. Yershova, L. M. Nikolayenko, Yu. N. Ponomarev, and V. M. Sinitsyn *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 43-44 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 720-741 Original language document announced in IAA as A85-15259 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14138# Joint Publications Research Service, Arlington, Va.
REGISTRY OF HEAVY IONS IN AURORAL REGION DURING MAGNETIC STORMS Abstract Only
Yu. V. Gotselyuk, S. N. Kuznetsov, and K. Kudela *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 44-45 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 742-748 Original language document announced in IAA as A85-15260 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14139# Joint Publications Research Service, Arlington, Va.
SMALL-SCALE STRUCTURE OF INTENSIVE LONGITUDINAL CURRENTS IN HIGH LATITUDES Abstract Only
A. S. Volokitin, V. V. Krasnoselskikh, Ye. V. Mishin, L. O. Tyurmina, V. A. Sharova, and S. I. Shkolnikova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 45 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 749-755 Original language document announced in IAA as A85-15261 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14140# Joint Publications Research Service, Arlington, Va.
FORMATION OF PROTON RADIATION BELTS IN REGION OF ENERGIES OF SEVERAL MeV Abstract Only
M. I. Panasyuk and E. N. Sosnovets *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 46 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 756-762 Original language document announced in IAA as A85-15262 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14146# Joint Publications Research Service, Arlington, Va.
CHARGE COMPOSITION OF ELECTRONS IN EARTH'S RADIATION BELT Abstract Only
B. I. Luchkov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 50-51 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 809-812 Original language document announced in IAA as A85-15269 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14167# Joint Publications Research Service, Arlington, Va.
SPACE APPLICATIONS IN GEOLOGY Abstract Only
N. Lesnaya *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 102-103 Transl. into ENGLISH from Leninskoye Znamya (Moscow), no. 81, 7 Apr. 1985 p 2-3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14185# Joint Publications Research Service, Arlington, Va.
METHODS FOR CONSTRUCTING ATMOSPHERIC OPTICAL TRANSFER OPERATOR Abstract Only
V. G. Zolotukhin, I. V. Mishin, D. A. Usikov, M. N. Fomenkova, and V. A. Grushin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 121-122 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 14-22 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14188# Joint Publications Research Service, Arlington, Va.
USE OF SPACE GEOLOGICAL METHODS IN SEISMOTECTONIC RESEARCH Abstract Only
T. P. Ivanova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 124 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 46-52 Original language document announced in IAA as A84-49030 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14189# Joint Publications Research Service, Arlington, Va.
ENGINEERING EVALUATION OF CRUSTAL FAULTS USING SPACE SURVEY DATA Abstract Only
A. L. Revzon *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 125 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 53-60 Original language document announced in IAA as A84-49031 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-13865 Harvard Univ., Cambridge, Mass.
THE INFLUENCE OF OCEANIC CHEMISTRY, PHYSICS AND BIOLOGY ON ATMOSPHERIC CARBON DIOXIDE Ph.D. Thesis
Fanny Knox Enever 1985 211 p
Avail: Univ. Microfilms Order No. DA8510201

A series of models was developed to predict the level of atmospheric CO2, resulting from given chemical, physical, and biological conditions in the ocean. The surface ocean is divided in these models into average warm surface water and cold, high-latitude region where water sinks out of contact with the atmosphere. The cold surface region is important in determining pCO2 and the extent of this influence depends upon the proportion of the return flow from the surface to the deep ocean which passes through the cold surface region, and also upon the relative magnitudes of the rates of exchange of carbon by gas transfer and on water flux. The chemical composition of the water in the cold surface region is determined by physical mixing of low-nutrient water from the warm surface ocean with high-nutrient water from below, and also by the degree of biological activity in the region. Changes in either physical or biological conditions have the potential to alter pCO2 in the cold surface water and thus in the atmosphere over a total range of several hundred parts per million. A model which includes separate consideration of the high-latitude ocean is used to explore possible conditions during the last glacial period which are in accord with the geological record and which can also account for a low value of atmospheric PCO2 during glacial time. A possible mechanism is presented by which alterations in the distribution of sunlight due to variations in the orbital parameters of the Earth can cause climate change, based on the direct response of biological activity to changing levels of light in high-latitude regions of the ocean. Dissert. Abstr.

N86-13866*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNDERSTANDING CLIMATE: A STRATEGY FOR CLIMATE MODELING AND PREDICTABILITY RESEARCH, 1985-1995
O. Thiele, ed. and R. A. Schiffer, ed. Oct. 1985 38 p refs (NASA-RP-1158; Rept-85B0489; NAS 1.61:1158) Avail: NTIS HC A03/MF A01 CSCL 04B

The emphasis of the NASA strategy for climate modeling and predictability research is on the utilization of space technology to understand the processes which control the Earth's climate system and it's sensitivity to natural and man-induced changes and to assess the possibilities for climate prediction on time scales of from about two weeks to several decades. Because the climate is a complex multi-phenomena system, which interacts on a wide

range of space and time scales, the diversity of scientific problems addressed requires a hierarchy of models along with the application of modern empirical and statistical techniques which exploit the extensive current and potential future global data sets afforded by space observations. Observing system simulation experiments, exploiting these models and data, will also provide the foundation for the future climate space observing system, e.g., Earth observing system (EOS), 1985; Tropical Rainfall Measuring Mission (TRMM) North, et al. NASA, 1984. Author

N86-13867*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VAS DEMONSTRATION: (VISSR ATMOSPHERIC SOUNDER) DESCRIPTION Final Report
H. E. Montgomery and L. W. Uccellini Oct. 1985 193 p refs
(NASA-RP-1151; Rept-85F0274; NAS 1.61:1151) Avail: NTIS HC A09/MF A01 CSCL 04B

The VAS Demonstration (VISSR Atmospheric Sounder) is a project designed to evaluate the VAS instrument as a remote sensor of the Earth's atmosphere and surface. This report describes the instrument and ground processing system, the instrument performance, the valiation as a temperature and moisture profiler compared with ground truth and other satellites, and assesses its performance as a valuable meteorological tool. The report also addresses the availability of data for scientific research. Author

N86-13868*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-51D)
G. L. Jasper, D. L. Johnson, C. K. Hill, and G. W. Batts (Computer Sciences Corp., Huntsville, Ala.) Jun. 1985 43 p refs
(NASA-TM-86524; NAS 1.15:86524) Avail: NTIS HC A03/MF A01 CSCL 04B

A summary of selected atmospheric conditions observed near the space shuttle STS-51D launch time on April 12, 1985, at Kennedy Space Center Florida is presented. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-51D vehicle ascent is constructed. The STS-51D ascent atmospheric data tape is compiled by Marshall Space Flight Center's Atmospheric Sciences Division to provide an internally consistent data set for use in post-flight performance assessments. Author

N86-13869*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA CATALOG SERIES FOR SPACE SCIENCE AND APPLICATIONS FLIGHT MISSIONS. VOLUME 4A: DESCRIPTIONS OF METEOROLOGICAL AND TERRESTRIAL APPLICATIONS SPACECRAFT AND INVESTIGATIONS
Carolyn Y. Ng, ed. and Yi-Tsuei P. Sheu, ed. Jul. 1985 126 p 11 Vol.
(NASA-TM-87501; NSSDC/WDC-A-R/S-85-03-Vol-4A; NAS 1.15:87501) Avail: NTIS HC A07/MF A01 CSCL 04B

The National Space Science Data Center (NSSDC) provides data from and information about space science and applications flight investigations in support of additional studies beyond those performed as the principal part of any flight mission. The Earth-orbiting spacecraft for investigations of the earth and its atmosphere is discussed. Geodetic tracking data are included in this category. The principal subject areas presented are meteorology and earth resources survey, and the spacecraft selection is made according to those subjects. All experiments on board the spacecraft are described. No attempt is made to reference investigations that are related to the above disciplines, but that are described in other volumes of this series. E.A.K.

N86-13870# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SAMPLING-RATE EFFECTS ON RADAR-DERIVED RAINFALL ESTIMATES M.S. Thesis
J. L. Fornear Aug. 1985 75 p
(AD-A158203; AFIT/CI/NR-85-67T) Avail: NTIS HC A04/MF A01 CSCL 04/2

This study investigates the errors due solely to sampling intervals that occur with radar-derived total rainfall estimates. The study was limited to nine cold-front passages over eastern Texas, in the Fall of 1984. Digitized, 10.3 cm wavelength radar observations were recorded using a one minute sampling-rate. Total rainfall estimates, for 10 km by 10 km areas, based on these data were considered ground truth totals. Sample-rates, ranging from 5 to 60 minutes, were applied to the recorded data to calculate total rain estimates for each sample rate. These derived rain totals were compared to the ground truth totals, with the differences referred to as errors. These errors were plotted against the sampling-rate. They ranged from over 100% for sample intervals greater than 50 minutes, to less than 25% for intervals less than 15 minutes. The errors were also plotted against the number of samples taken. There was no significant increase in estimate accuracy when greater than seven samples were taken per 80 minute period. Other variables, the mean rain rate, total rain, sequential variability, storm width, and storm speed of movement, were found to have very low correlations with the errors. GRA

N86-13871# Technische Univ., Hanover (West Germany).
METEOROLOGICAL AND CLIMATOLOGICAL CONDITIONS AFFECTING THE VERTICAL STRUCTURE OF VISIBILITY IN NORTHERN GERMANY Final Technical Report, 18 Jan. - 31 Aug. 1985
R. Roth Jun. 1985 162 p
(Contract DAJA37-82-C-0189; DA Proj. 1L1-61102-BH-57)
(AD-A158254; R/D-4033-EN-01) Avail: NTIS HC A08/MF A01 CSCL 04/2

The objective of the program was to establish a climatology of the visibility profile within the height range of 2 to 300m for northern Germany. To achieve this objective continuous measurements of the visual range, temperature and dewpoint temperature at six different height levels on a 300m-radiomast, as well as the registration of the cloud ceiling up to 1500m were performed for about 2.5 years. For selected weather situations additional high resolution vertical soundings by means of a tethersonde in accordance with sodar measurements supplied more detailed data. It turned out that the visibility profile is strongly correlated to the weather situation (low, high etc.) depending on the time of the day and on the season. GRA

N86-13872# Lawrence Livermore National Lab., Calif.
STATISTICAL COMPARISON OF TWO MAJOR GRIDDED TEMPERATURE RECORDS OF THE NORTHERN HEMISPHERE
S. L. Grotch Jul. 1985 5 p refs Presented at the 9th Conf. on Probability and Statist. In Atmospheric Sci., Virginia Beach, Va., 9 Oct. 1985
(Contract W-7405-eng-48)
(DE85-016076; UCRL-92933; CONF-851028-48) Avail: NTIS HC A02/MF A01

The global surface temperature records of the Climate Research Unit (CRU) of the university of East Anglia and that of the Russians were compared to examine their accuracy and any possible discrepancies. The CRU and the Russian gridded temperature curves are in excellent agreement when average Northern Hemisphere behavior is compared. There are, however, several grid points where differences between the two data sets warrant further study. DOE

N86-13873# Emertron, Inc., Silver Spring, Md. Dept. of Electrical Engineering.
HORIZONTAL ELECTRIC FIELDS FROM LIGHTNING RETURN STROKES
E. M. Thomson, M. A. Uman, J. Johnson, J. W. Stone, P. Medelius, and M. Rubenstein 1985 8 p Presented at the Intern. Conf. on Lightning and Static Elec., Paris, 10 Jun. 1985
(Contract DE-AC05-840R-21400)
(DE85-016367; CONF-8506121-2) Avail: NTIS HC A02/MF A01

Measurements are presented of simultaneous horizontal and

vertical electric fields from both close and distant lightning return strokes. The data were obtained during summer 1984 at the Kennedy Space Center, Florida, using an electrically isolated spherical antenna with a system bandwidth of 3 Hz to 5 MHz. Lightning signals were obtained from flashes at distances from a few to 100 kilometers. Since the horizontal electric field is in part determined by the local ground conductivity, that parameter was measured as a function of depth. The horizontal fields from lightning return strokes had typically 1/50 the peak amplitude of the vertical fields and waveshapes which were consistant with available theory, as expressed by the wavetilt formula. DOE

N86-13766# Joint Publications Research Service, Arlington, Va.
GOSKOMGIDROMET PLANS AUTOMATION OF AERIAL CLOUD-SEEDING WORK Abstract Only
Vera Dorofeyeva and Vil Dorofeyev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 2 Transl. into ENGLISH from Literaturnaya Gazeta (Moscow), 26 Jun. 1985 p 11 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13770# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF CHARACTERISTICS OF SYNOPTIC MOVEMENTS ON SPHERE Abstract Only
A. D. Marushkevich *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 11 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 386-394 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13782# Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN MEASURING MEAN WIND VELOCITY PROFILE IN LOWER TROPOSPHERE BY SODAR ANEMOMETER UNDER INVERSION AND CONVECTIVE CONDITIONS Abstract Only
M. A. Kallistratova, Y. Keder, I. V. Petenko, and N. S. Time *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 30-31 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 492-497 Original language document was announced in IAA as A85-40641 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13783# Joint Publications Research Service, Arlington, Va.
STRUCTURAL CHARACTERISTIC OF TEMPERATURE FIELD OVER SEA Abstract Only
B. M. Koprov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 31-32 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 5, May 1985 p 485-491 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14098*# Texas A&M Univ., College Station. Dept. of Meteorology.
VARIABILITY OF RAINFALL OVER SMALL AREAS Final Report
Robert C. Runnels *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 7 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-13874# VMI Research Labs., Lexington, Va.
THE DESIGN OF A BEACH PROFILER Final Report, 22 Feb. 1985 - 21 Feb. 1986
R. A. Erchul Jun. 1985 77 p
(Contract N00014-85-K-0303)
(AD-A157715) Avail: NTIS HC A05/MF A01 CSCL 13/2

Three designs of a beach profiler system were designed by VMI cadets as a part of requirements in the VMI's course Coastal Engineering. All the systems were designed to measure the water depth in the surf zone to within + or - one foot accuracy under all weather conditions. All systems designs used a pressure sensor to measure depth, however, each varied in method of employing this sensor. Two of the designs propelled the sensing unit sub-system while the third design used a push-pull method of employment. The distance of employment into the surf zone varied from 300 to 3,000 feet. The designed systems were fairly economical in cost ranging from $2,020.00 to $4,348.00. Projected scenarios of operations varied in the systems used requiring from one to six personnel for employment. Author (GRA)

N86-13875# Naval Research Lab., Washington, D. C.
LABORATORY STUDIES OF STEEP AND BREAKING DEEP WATER WAVES IN A CONVERGENT CHANNEL Memorandum Report, Aug. 1983 - May 1985
S. E. Ramberg, M. E. Barber, and O. M. Griffin 21 Aug. 1985 45 p
(NR Proj. RR0-2301)
(AD-A158187; NRL-MR-5610) Avail: NTIS HC A03/MF A01 CSCL 08/3

In the present experiments, waves were made to steepen by a convergent section which was installed in NRL's 30m long wave channel. These and other recent experiments have demonstrated that a criterion for the onset of breaking for deep water waves can be simply stated in terms of the wave steepness at breaking. This criterion states that the wave steepness at the onset of breaking is given by $H/L^* =$ approx. 0.11, where H is the wave height and L^* is the Stokes limiting wavelength. On the evidence available thus far the simple steepness criterion applies equally well to spilling and plunging breakers. Criteria such as this can be readily used to predict the frequency of occurrence of breaking for deep water waves. There are more complex questions relating to energy losses in breaking and related topics which cannot be addressed so simply. From the results of the present experiments it appears that the potential energy loss rates of plunging breakers are twice those of spilling breakers in deep water. Moreover, the potential energy losses in breaking did not significantly alter the total mean drift and return flows in the channel. Most of the energy lost goes into the production of turbulence and into air entrainment in the breaking region. GRA

N86-13876# Naval Research Lab., Washington, D. C.
A FAMILY OF CURVES FOR THE ROUGH SURFACE REFLECTION COEFFICIENT Final Report, 1983 - 1984
A. R. Miller and E. Vegh 31 Jul. 1985 21 p
(NR Proj. W12-53)
(AD-A158195; NRL-8898) Avail: NTIS HC A02/MF A01 CSCL 08/3

This report puts forward statistical models for the sea surface which are used to derive a family of theoretical curves for the rough surface reflection coefficient. One of these curves fits the experimental data curve. Other experimental data points lie within the envelope of the derived curves. There is, therefore, a theoretical basis for the experimental data when the surface roughness exceeds 0.1 rad. GRA

N86-13877# Los Alamos National Lab., N. Mex.
THREE-DIMENSIONAL MODELING OF TSUNAMI WAVES
C. L. Mader 1985 7 p refs Presented at the Tsunami Symp., Victoria, British Columbia, 6 Aug. 1985
(Contract W-7405-eng-36)
(DE85-015724; LA-UR-85-2412; CONF-8508112-1) Avail: NTIS HC A02/MF A01

Two and three-dimensional, time-dependent, nonlinear, incompressible, viscous flow calculations of realistic models of tsunami wave formation and run up have been performed using the Los Alamos-developed SOLA-3D code. The results of the SOLA calculations are compared with shallow-water, long-wave calculations for the same problems using the SWAN code. Tsunami wave

formation by a continental slope subsidence has been examined using the two numerical models. The SOLA waves were slower than the SWAN waves and the interaction with the shoreline was more complicated for the SOLA waves. In the SOLA calculation, the first wave was generated by the cavity being filled along the shoreline close to the source of motion. The second wave was generated by the cavity being filled from the deep water end. The two waves interacted along the shoreline resulting in the second wave being the largest wave with a velocity greater than the first wave. The second wave overtook the first wave at later times and greater distances from the source. In the SWAN calculation, the second wave was smaller than the first wave. DOE

N86-13769# Joint Publications Research Service, Arlington, Va.
COMPUTATION OF OCEAN UPPER LAYER THERMAL STRUCTURE Abstract Only
A. Yu. Benilov, N. G. Kozhelupova, and B. N. Filyushkin *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 10 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 378-385 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13771# Joint Publications Research Service, Arlington, Va.
VERTICAL STRUCTURE OF TURBULENCE AND TURBULENT EXCHANGE IN EQUATORIAL ZONE OF PACIFIC OCEAN Abstract Only
A. N. Gezentsvey *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 12-13 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 414-419 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13772# Joint Publications Research Service, Arlington, Va.
SOME CHARACTERISTICS OF BOTTOM DENSITY CURRENTS Abstract Only
V. N. Anuchin, V. M. Belokopytov, and V. A. Gritsenko *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 13-14 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 420-424 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13773# Joint Publications Research Service, Arlington, Va.
HIGHLY DISPERSE MINERALS IN SEDIMENTS IN NEIGHBORHOOD OF EAST PACIFIC OCEAN RISE DETERMINED FROM DRILLING DATA Abstract Only
Z. N. Gorbunova *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 14-15 Transl. into ENGLISH from Okeanol. (Moscow), v. 25, no. 3, May - Jun. 1985 p 465-470 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14171# Joint Publications Research Service, Arlington, Va.
EQUATORIAL WAVES IN OCEAN SURFACE TEMPERATURE FIELD ACCORDING TO DATA FROM SHIPBOARD AND SATELLITE MEASUREMENTS Abstract Only
A. S. Kazmin, R. Legeckis, and K. N. Fedorov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 108-109 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 3-7 Original language document announced in IAA as A85-16940 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-13878*# Louisville Univ., Ky. Dept. of Microbiology and Immunology.
DEVELOPMENT AND TESTING OF A MOUSE SIMULATED SPACE FLIGHT MODEL Semiannual Progress Report, May - Oct. 1985
Gerald Sonnenfeld 1985 6 p refs
(Contract NCC2-213)
(NASA-CR-176359; NAS 1.26:176359; SAPR-6) Avail: NTIS HC A02/MF A01 CSCL 06C

The development and testing of a mouse model for simulating some aspects of weightlessness that occur during space flight, and the carrying out of immunological flight experiments on animals was discussed. The mouse model is an antiorthostatic, hypokinetic, hypodynamic suspension model similar to the one used with rats. It is shown that this murine model yield similar results to the rat model of antiorthostatic suspension for simulating some aspects of weightlessness. It is also shown that mice suspended in this model have decreased interferon-alpha/beta production as compared to control, nonsuspended mice or to orthostatically suspended mice. It is suggested that the conditions occuring during space flight could possibly affect interferon production. The regulatory role of interferon in nonviral diseases is demonstrated including several bacterial and protozoan infections indicating the great significance of interferon in resistance to many types of infectious diseases. E.A.K.

N86-13879*# National Aeronautics and Space Administration, Washington, D. C.
LIFE SCIENCES ACCOMPLISHMENTS
Sep. 1985 95 p refs Original contains color illustrations
(NASA-TM-88177; NAS 1.15:88177) Avail: NTIS HC A05/MF A01 CSCL 06C

From its inception, the main charter of Life Sciences has been to define biomedical requirements for the design and development of spacecraft systems and to participate in NASA's scientific exploration of the universe. The role of the Life Sciences Division is to: (1) assure the health, well being and productivity of all individuals who fly in space; (2) study the origin, evolution, and distribution of life in the universe; and (3) to utilize the space environment as a tool for research in biology and medicine. The activities, programs, and accomplishments to date in the efforts to achieve these goals are detailed and the future challenges that face the division as it moves forward from the shuttle era to a permanent manned presence in space space station's are examined. E.A.K.

N86-13880# Wisconsin Univ., Madison.
STUDY OF TOXIC AND ANTIGENIC STRUCTURES OF BOTULINUM NEUROTOXINS Annual and Final Report, 1 Aug. 1980 - 31 Aug. 1984
B. R. DasGupta Feb. 1985 14 p
(Contract DAMD17-80-C-0100; DA Proj. 3M1-62770-A-871)
(AD-A156642) Avail: NTIS HC A02/MF A01 CSCL 06/5

Amino acid compositions of botulinum neurotoxin (NT) types A, B, E and F were determined. The heavy and light chains of types A, B and E NT were separated, purified, and analyzed for amino acid compositions and partial N-terminal sequence. Selective modification of tyr, his and arg residues and also carboxyl and amino groups of types A and E NT demonstrated the role of these amino acid residues in toxicity and antiquenicity. Type E NT completely detoxified following modification of his, tyr or amino groups has potential as a toxoid. Effects of types A and B NT on rat neuromuscular junctions appear non-identical. Author (GRA)

N86-13881# Systems and Applied Sciences Corp., Anaheim, Calif.
NEW PHYSICAL METHODS FOR BIOLOGICAL AEROSOL DETECTION Contractor Report, Aug. 1982 - Sep. 1984
C. C. Chou and M. Lu May 1985 99 p
(Contract DAAK11-82-C-0113)
(AD-A158218; CRDC-CR-84131) Avail: NTIS HC A05/MF A01 CSCL 15/2

For biological aerosol detection, Fourier transform secondary negative ion mass spectrometry appears to be on the forefront among various new analytical methods evaluated. Various gases liberated upon pyrolyzing bacterial cells lead to several possible techniques. Preliminary experimental results indicated an integrated detection system incorporating non-dispersive IR spectroscopy,

piezoelectric sensing, and optical density change measurement would render a fast, accurate detection for pyrolysis gaseous products. GRA

N86-13882# Stanford Univ., Calif.
SMALL X-RAY DIFFRACTION OF IMMUNOGLOBULIN-MEMBRANE COMPLEXES Final Technical Report, 15 Apr. 1981 - 14 Oct. 1984
S. Doniach and K. Hodgson 15 Aug. 1985 8 p
(Contract N00014-81-K-0496)
(AD-A158252) Avail: NTIS HC A02/MF A01 CSCL 06/1

In the first part of this research, specially designed hapten-phospholipid molecules were synthesized to enable the binding of immunoglobulins to artificial phospholipid membranes. In subdequent work, using these immunoglobulin-membrane complexes, electron microscopy was used to reveal the detailed crystalline structure of a two dimensional (2D) immunoglobulin crystal attached to an electron microscope grid. These studies enabled the discovery of a new conformational arrangement of crystals formed from intact immunoglobulin molecules. In a third part of the study, monolayers of protein-membrane complex (in this case the purple membrane from halobacterium halobium) were deposited on a single crystal silicon substrate. Using the technique of grazing incidence X-ray diffraction, diffraction patterns from a single monolayer of protein-lipid complex were obtained for the first time. GRA

N86-13883# Battelle Northwest Labs., Richland, Wash.
DESIGN, CONSTRUCTION AND TESTING OF A dc BIOEFFECTS ENCLOSURE FOR SMALL ANIMALS Final Report
Jul. 1985 180 p refs Sponsored by EPRI
(Contract DE-AC06-76RL-01830; EPRI Proj. 1774-1)
(DE05-016798; EPRI-EA-4189) Avail: NTIS HC A09/MF A01

Large air-ion concentrations moving in high-strength static electric fields are unique to the environment near high-voltage dc (HVdc) transmisison lines. To assess the possible biological effects of this environment, a small-animal exposure system was designed to produce well-characterized levels of the major components of the HVdc environment. Initial steps in the development of this exposure system included studies of various housing geometries and housing materials. Dielectric materials, such as plexiglass and lexan, unacceptably perturbed electric-field and air-ion environments in their vicinity these perturbations depended on the cleanliness of the housing materials and were spatially and temporally variable. Semiconducting materials were also investigated, with satisfactory results. The final cage design employs semiconducting glass walls which span the entire space between the grounded metal-screen cage floors the overhead high-voltage electrodes used to generate the exposure electric fields. The surface conductivity of the glass walls is controlled by a system of energized guard strips located on the outer surfaces of the walls. Electric-field strengths up to 100 kV/m and air-ion concentrations up to 1,000,000 cu b c, are attainable. Initial dosimetric measurements were also performed as part of this project. The ion current collected by the body of a grounded animal was measured as a function of ion concentration and electric-field strength. The ion current collected by a live animal was observed to be significantly less than that collected by a conducting animal model of similar size and shape. This deviation appears to be due to accumulation of electric charge on the fur of exposed animals. DOE

N86-13884# Washington Univ., Seattle. Social Management of Technology Program.
MOLECULAR MECHANISMS OF MUTAGENESIS DETERMINED BY THE RECOMBINANT DNA TECHNOLOGY
W. R. Lee 1985 10 p refs Presented at the 4th Intern. Conf. on Environ. Mutagens, Stockholm, 24 Jun. 1985
(Contract DE-AS05-76EV-03728)
(DE85-016353; CONF-8506137-11) Avail: NTIS HC A02/MF A01

A study of the alteration of the DNA in the mutant gene can determine mechanisms of mutation by distinguishing between mutations induced by transition, transversion, frameshifts of a single base and deletions involving many base pairs. The association of a specific pattern of response with a mutagen will permit detecting mutants induced by the mutagen with a reduced background by removing mutations induced by other mechanisms from the pool of potential mutants. From analyses of studies that have been conducted, it is quite apparent that there are substantial differences among mutagens in their modes of action. Of 31 X-ray induced mutants, 20 were large deletions while only 3 showed normal southern blots. Only one mutant produced a sub-unit polypeptide of normal molecular weight and charge in the in vivo test whereas in vitro synthesis produced a second one. In contrast, nine of thirteen EMS induced mutants produced cross-reacting proteins with sub-unit polypeptide molecular weights equivalent to wild type. DOE

N86-13885# Southwest Research Inst., San Antonio, Tex.
EFFECTS OF 60 Hz ELECTRIC FIELDS ON OPERANT AND SOCIAL STRESS BEHAVIORS OF NONHUMAN PRIMATES Project Technical Status Report, 16 Feb. - 12 Apr. 1985
W. R. Rogers 19 Apr. 1985 33 p
(Contract DE-AC02-80RA-50219)
(DE85-011992; DOE/RA-50219/T4) Avail: NTIS HC A03/MF A01

The objective was to investigate possible behavioral effects of exposure to high-intensity 60 Hz electric fields. Four projects are conducted: (1) aversive sensory character of exposure to fields, (2) threshold intensity for detection of fields, (3) chronic exposure effects on performance of two operant tasks, and (4) observation of behavior of social groups under chronic exposure. Electric field testing with animals has begun. Behavioral testing was suspended for repair of cages and to suppress corona, and to conduct engineering tests. DOE

N86-14080*# Fayetteville State Univ., N.C. Dept. of Biology.
THE SCANNING ELECTRON MICROSCOPE AS A TOOL IN SPACE BIOLOGY Final Report
Roy A. Barrett *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06B

N86-14088*# North Texas State Univ., Denton. Dept. of Biological Sciences.
INTERACTION BETWEEN ESCHERICHIA COLI AND LUNAR FINES Final Report
Karl R. Johansson *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 21 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06B

N86-14097*# Morgan State Univ., Baltimore, Md.
COMPARATIVE EFFECT OF LUNAR FINES AND TERRESTRIAL ASH ON THE GROWTH OF A BLUE-GREEN ALGA AND GERMINATING RADISH SEEDS Final Report
Esther J. Ridley *In* NASA. Johnson (Lydon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06B

N86-14162# Joint Publications Research Service, Arlington, Va.
ENERGY EXCHANGE OF PLANTS UNDER WEIGHTLESSNESS CONDITIONS Abstract Only
M. G. Tairbekov and A. V. Devyatko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 80 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 280, no. 2, Jan. 1985 p 509-512 Original language document announced in IAA as A85-24193 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-13886*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
ENDOCRINE AND FLUID METABOLISM IN MALES AND FEMALES OF DIFFERENT AGES AFTER BEDREST, ACCELERATION AND LOWER BODY NEGATIVE PRESSURE
Carolyn S. Leach, Joan Vernikos-Danellis (NASA. Ames Research Center), Jane M. Krauhs (Northrop Services, Inc., Houston, Tex.), and Harold Sandler (NASA. Ames Research Center) Nov. 1985 52 p refs
(NASA-TM-58270; S-550; NAS 1.15:58270) Avail: NTIS HC A04/MF A01 CSCL 06S

Space shuttle flight simulations were conducted to determine the effects of weightlessness, lower body negative pressure (LBNP), and acceleration of fluid and electrolyte excretion and the hormones that control it. Measurements were made on male and female subjects of different ages before and after bedrest. After admission to a controlled environment, groups of 6 to 14 subjects in the age ranges 25 to 35, 35 to 45, 45 to 55 to 65 years were exposed to +3 G sub z for 15 minutes (G1) and to LBNP (LBNP1) on different days. On 3 days during this prebedrest period, no tests were conducted. Six days of bedrest followed, and the G sub z (G2) and LBNP (LBNP2) tests were run again. Hormones, electrolytes, and other parameters were measured in 24-hour urine pools throughout the experiment. During bedrest, cortisol and aldosterone excretion increased. Urine volume decreased, and specific gravity and osmolality increased. Urinary electrolytes were statistically unchanged from levels during the non-stress control period. During G2, cortisol increased significantly over its control and bedrest levels. Urine volume, sodium, and chloride were significantly lower; specific gravity and osmolality were higher during the control period or bedrest. The retention of fluids and electrolytes after +G sub z may at least partially explain decreased urine volume and increased osmolality observed during bedrest in this study. There were some who indicated that space flight would not affect the fluid and electrolyte metabolism of females or older males any more severely than it has affected that of male astronauts. Author

N86-13887# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE EFFECT OF SPIRONOLACTONE ON THE CARDIOCIRCULATORY RESPONSES TO UPRIGHT TILT AT SEA LEVEL AND AT SIMULATED HIGH ALTITUDE
C. S. Fulco, R. Larsen, P. B. Rock, A. J. Young, and A. Cymerman 19 Jun. 1985 18 p
(DA Proj. 3E1-62777-A-879)
(AD-A157734; USARIEM-M33/85) Avail: NTIS HC A02/MF A01 CSCL 06/15

The objective of this study was to determine if spironolactone (S) alters the cardiocirculatory responses to upright tilt at sea level (SL;50m) and during 44 hours of simulated altitude (HA;4600m). In a double-blind, crossover-designed study, 9 male subjects (age range: 18 to 25 years) received 25 mg orally, 4x/day of either S or an identically-appearing placebo (P) 2 days prior to and during HA. The crossover was separated by two weeks. Heart rate, stroke volume, cardiac output, calf blood flow, total peripheral resistance and system blood pressure were obtained during supine rest and after 10 minutes of 60 degree head-up tilt using an impedance monitor and an electro-sphygmomanometer. Twenty-four hour determinations of urinary volume, sodium and potassium, as well as venous plasma values for sodium, potassium and chloride were obtained daily. There were no statistically significant differences between P and S treatment periods for: caloric, electrolytes; of fluid ingestion; urinary volume or electrolytes; plasma electrolytes; or any of the cardiocirculatory parameters measured in the supine or upright position at SL or during HA. It was concluded that S did not induce a significant diuresis or significantly alter vascular responsiveness to negatively effect the normal cardiocirculatory responses to upright tilt at sea level or simulated high altitude. GRA

N86-13888# School of Aerospace Medicine, Brooks AFB, Tex.
INTERACTIVE SCENARIO COMPUTER MODEL FOR DOSE RATES TO AIRCREWS IN FLIGHT THROUGH NUCLEAR DEBRIS CLOUDS Final Report, Dec. 1981 - Oct. 1984
J. Taboada, D. Hegedusich, and E. L. Bell Jul. 1985 18 p
(AD-A158741; USAFSAM-TR-85-49) Avail: NTIS HC A02/MF A01 CSCL 06/18

An interactive computer model is described for the rapid calculation of gamma radiation doses to aircrews in hypothetical flights through nuclear debris clouds. The model is based on CASSANDRA, a U.S. army developed code for dust concentration calculations at loci through such a cloud. The present model computes local radiation dose integrals along a user-specified flight path. It is designed for efficient interactive operation on a Digital Equipment Corporation Model VAX 11/780 computer. GRA

N86-13889# Northwestern Univ., Evanston, Ill.
ENHANCING SENSITIVITY TO VISUAL MOTION AND ENHANCING VISUAL SENSITIVITY Interim Report, 1 Oct. 1981 - 30 Sep. 1983
R. Sekuler 4 Jun. 1985 28 p
(Grant AF-AFOSR-0246-80)
(AD-A158800; AFOSR-85-0668TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

This report describes progress made from October 1, 1981 to September 30, 1983. During this period work proceeded on three main lines of study: (1) various aspects of visual motion perception, (2) collaborative work on contrast sensitivity and pilots' performance in aircraft simulators, and 3) individual differences in responses to temporal transients. The most extensive of the three work-units dealt with motion perception by human observers. The main findings include the following: (1) Perceived speed of a moving target varies with that target's contrast and retinal eccentricity. In particular, many targets undergo illusory slowing when they appear in the periphery in the visual field, (2) detection of a moving target is often dissociated from the ability to identify the direction in which the target moves. In particular, the accuracy with which target direction can be judged, even for highly visible targets, seems to far less good than previously suspected, (3) relatively small amounts of training can significantly improve an observer's ability to discriminate between two highly similar directions of target motion. Moreover, this effect is well-restricted to the training direction and other, similar directions; the training effect is retained without decrement for at least two months. The results suggest that this improvement with training represents a genuine change in visual function. GRA

N86-13890# Air Force Human Resources Lab., Brooks AFB, Tex.
PILOT-ORIENTED PERFORMANCE MEASUREMENT Final Report, Jan. - Dec. 1983
J. DeMaio, H. H. Bell, and J. Brunderman Aug. 1985 15 p
(AF Proj. 2313)
(AD-A158849; AFHRL-TP-85-18) Avail: NTIS HC A02/MF A01 CSCL 14/2

Aircrew performance measurement is a critical problem in evaluating the quality of a visual simulation system and in determining the effectiveness of aircrew training devices. An effective performance measurement system must be able to separate performance into appropriate components and describe the relationship of these components. This paper describes a performance measurement system developed to analyze pilot performance in maintaining altitude in both straight and turning flight as a function of the object density of the simulated visual environment. The analysis indicates that pilot performance can be divided into perceptual and task difficulty factors and that the effect of the visual environment on each of these factors can be determined. A prototype performance measurement system was developed to describe pilot performance in a simulator. The pilot's task was to maintain altitude at 200 feet both in straight and in turning flight. Pilot performance was sensitive to task difficulty

and to visual scene quality. The strength of this performance measurement system was that it analyzed performance in terms of overall task performance and also specific pilot control inputs. GRA

N86-13891# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
HEALTH HAZARD EVALUATION OF LIQUID MONOPROPELLANTS. PHASE 5: COMPARATIVE INHALATION TOXICITIES OF LGP 1776, LGP 1845, AND HAN (HYDROXYLAMMONIUM NITRATE) Final Report
H. L. Snodgrass, Jr. Jun. 1985 33 p
(AD-A159090; USAEHA-75-51-0132-85) Avail: NTIS HC A03/MF A01 CSCL 06/20

A comparison of the inhalation toxicities of two liquid gun propellant (LGP) formulations, LGPs 1776 and 1845, was made using rats. Also assessed was the major chemical component of each, hydroxylammonium nitrate (HAN). Rats exposed to saturated vapors of the two LGPs for 8 hours were uneffected. Following single acute aerosol exposures, LGP 1845 was more toxic, with deaths occurring at concentrations of 1350 to 1603 mg/cu m. After 5 or 10 daily aerosol exposures to the three formulations, comparable dose-dependent effects were noted. These included hematological, organ-to-body weight ratio, and pathological changes, generally at the highest exposure level of 600 mg/cu m. It is concluded that acute exposures to LGP vapors should not be hazardous to man. Also inferred is that the effects of repeated, sublethal exposures to LGPs 1776 and 1845 are quantitatively similar to those observed with HAN, the major chemical component. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-13892*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF DIGITAL ALTIMETRY ON PILOT WORKLOAD
Randall L. Harris, Sr. and Bobby J. Glover Nov. 1985 20 p refs
(NASA-TM-86424; L-15989; NAS 1.15:86424) Avail: NTIS HC A02/MF A01 CSCL 05H

A series of VOR-DME instrument landing approaches was flown in the DC-9 full-workload simulator to compare pilot performance, scan behavior, and workload when using a computer-drum-pointer altimeter (CDPA) and a digital altimeter (DA). Six pilots executed two sets of instrument landing approaches, with a CDPA on one set and a DA on the other set. Pilot scanning parameters, flight performance, and subjective opinion data were evaluated. It is found that the processes of gathering information from the CDPA and the DA are different. The DA requires a higher mental workload than the CDPA for a VOR-DME type landing approach. Mental processing of altitude information after transitioning back to the attitude indicator is more evident with the DA than with the CDPA. E.A.K.

N86-13893# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
HYPOTHESIZING AND REFINING CAUSAL MODELS
R. J. Doyle Dec. 1984 109 p
(Contract N00014-80-C-0505; NR Proj. RR0-1408)
(AD-A158165; AI-M-811) Avail: NTIS HC A06/MF A01 CSCL 06/4

An important common sense competence is the ability to hypothesize causal relations. This paper presents a set of constraints which make the problem of formulating causal hypotheses about simple physical systems a tractable one. The constraints include: (1) a temporal and physical proximity requirement; (2) a set of abstract causal explanations for changes in physical systems in terms of dependences between quantities; and (3) a teleological assumption that dependences in designed physical systems are functions. These constraints were embedded in a learning system which was tested in two domains: a sink and a toaster. The learning system successfully generated and refined naive causal models of these simple physical systems. The causal models which emerge from the learning process support causal reasoning explanation, prediction, and planning. Inaccurate predictions and failed plans in turn indicate deficiencies in the causal models and the need to rehypothesize. Thus, learning supports reasoning which leads to further learning. The learning system makes use of standard inductive rules of inference, as well as the constraints of casual hypotheses to generalize its casual models. Finally, a simple example involving an analogy illustrates another way to repair incomplete causal models. GRA

N86-13894# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
GENERATING AND GENERALIZING MODELS OF VISUAL OBJECTS Memorandum Report
J. H. Connell and M. Brady Jul. 1985 26 p
(Contracts N00014-80-C-0505; N00014-77-C-0389)
(AD-A158197; AI-M-823) Avail: NTIS HC A03/MF A01 CSCL 06/4

We report on initial experiments with an implemented learning system whose inputs are images of two-dimensional shapes. The system first builds semantic network descriptions of shapes based on Brady's smoothed local symmetry representation. It learns shape models from them using a substantially modified version of Winston's ANALOGY program. A generalization of Gray coding enables the representation to be extended and also allows a single operation, called ablation, to achieve the effects of many standard induction heuristics. The program can learn disjunctions, and can learn concepts using only positive examples. We discuss learnability and the pervasive importance of representational hierarchies. GRA

N86-13895# Washington Univ., St. Louis, Mo. Behavior Research Lab.
A PSYCHOPHYSIOLOGICAL MAPPING OF COGNITIVE PROCESSES Annual Report, 1 Mar. 1984 - 28 Feb. 1985
R. Goldstein, J. Stern, and L. Bauer 30 Apr. 1985 49 p
(Contract F49620-83-C-0059)
(AD-A158732; Rept-0059-85-1; AFOSR-85-0664TR; AR-2) Avail: NTIS HC A03/MF A01 CSCL 05/10

The experiment was concerned with the effects of varied cognitive and perceptual (i.e., monitoring) demands on patterns of physiological responding. Cognitive demands were varied by manipulating the number of letters (1, 3, or 5) comprising a briefly-presented set which the subject was instructed to encode, rehearse, and, 5 sec later, compare to a single test letter. Perceptual demands were varied by presenting the subject with a cue stimulus 5 sec prior to the set, informing him of the number of letters contained therein. Several physiological measures were recorded, including HR, EOG and probe evoked potentials sampled from the intervals preceding and following the letter set, and task evoked potentials and blinks elicited by the cue, letter set, and test stimuli. Performance data, i.e., RT and error rates, were also recorded. GRA

N86-13896# Smith-Kettlewell Inst. of Visual Sciences, San Francisco, Calif.
THE SPATIAL AND TEMPORAL PARAMETERS OF VELOCITY DISCRIMINATION Annual Report, 1 Apr. - 30 Sep. 1984
S. P. McKee 20 Dec. 1984 8 p
(Grant AF-AFOSR-0345-82)
(AD-A158735; AFOSR-85-0572TR) Avail: NTIS HC A02/MF A01 CSCL 06/16

The target duration required for the precise discrimination of velocity is quite short, amounting to about 100 msec for a single moving dot or line target. While stroboscopic motion is an adequate substitute for continuous motion in velocity discrimination, optimal discrimination depends on the use of a strobe rate greater than 10 Hz. Generally, human observers have difficulty detecting acceleration in moving targets. Over small distances (0.5 to 1

deg), timing signals from adjacent targets presented in a sequence are pooled, so that information about their relative onset time is lost. For example, given three adjacent lines, separated spatially by 0.1 deg and presented in a sequence (apparent motion) observers are unable to discriminate between a sequence in which a 10 msec interval separates the second from the reverse order (30 msec followed by 10 msec). Velocity discrimination is not affected by blur. Sinusoidal grating targets of 3 cycles per degree or lower produce excellent discrimination. Sinusoidal gratings above 3 cycles per degree in spatial frequency are not adequate for fast velocities (> 1 deg/sec). GRA

N86-13897# Illinois Univ., Champaign. Cognitive Psychophysiology Lab.
THE EVENT RELATED BRAIN POTENTIAL AS AN INDEX OF INFORMATION PROCESSING, COGNITIVE ACTIVITY, AND SKILL ACQUISITION: A PROGRAM OF BASIC RESEARCH Final Report, 1 Sep. 1983 - 31 Aug. 1984
E. Donchin, C. Wickens, and M. G. H. Coles 28 Feb. 1985 774 p
(Contract F49620-83-C-0144)
(AD-A159118; CPL-85-1; AFOSR-85-0662TR) Avail: NTIS HC A99/MF A02 CSCL 05/10

We review a program of research designed to understand the event-related brain potential (ERP) so that it can be used as a tool in the study of cognitive function and in the assessment of man-machine systems. We have conducted a series of studies on the functional significance of ERPs and have demonstrated that the P300 component is related to memory processes. We have used measures of the same component to evaluate workload, to time mental processes, to study the reciprocity of processing resources, and to extend theories of human information processing. We have also made technical advances in the analysis of the distribution of electrical potentials across the scalp. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-13898*# Hamilton Standard, Windsor Locks, Conn.
DEVELOPMENT OF A CARBON FORMATION REACTOR FOR CARBON DIOXIDE REDUCTION Final Report
Gary Noyes Sep. 1985 92 p refs
(Contract NAS9-16956)
(NASA-CR-171907; NAS 1.26:171907; SVHSER-9811) Avail: NTIS HC A05/MF A01 CSCL 06K

Applied research, engineering development, and performance evaluation were conducted on a process for formation of dense carbon by pyrolysis of methane. Experimental research showed that dense (0.7 to 1.6 g/cc bulk density and 1.6 to 2.2 g/cc solid density) carbon can be produced by methane pyrolysis in quartz-wool-packed quartz tubes at temperatrues of 1100 to 1300 C. This result supports the condensation theory of pyrolytic carbon formation from gaseous hydrocarbons. A full-scale Breadboard Carbon Formation Reactor (CFR) was designed, fabricated, and tested at 1100 to 1200 C with 380 to 2280 sccm input flows of methane. Single-pass conversion of methane to carbon ranged from 60 to 100 percent, with 89 percent average conversion. Performance was projected for an Advanced Carbon Reactor Subsystem (ACRS) which indicated that the ACRS is a viable option for management of metabolic carbon on long-duration space missions. Author

N86-13899*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MASS LOSS OF SHUTTLE SPACE SUIT ORTHOFABRIC UNDER SIMULATED IONOSPHERIC ATOMIC OXYGEN BOMBARDMENT
William Lewis Miller Nov. 1985 14 p refs
(NASA-TM-87149; E-2777; NAS 1.15:87149) Avail: NTIS HC A02/MF A01 CSCL 06K

Many polymeric materials used for thermal protection and insulation on spacecraft degrade significantly under prolonged bombardment by ionospheric atomic oxygen. The covering fabric of the multilayered shuttle space suit is composed of a loose weave of GORE-TEX fibers, Nomex and Kevlar-29, which are all polymeric materials. The complete evaluation of suit fabric degradation from ionospheric atomic oxygen is of importance in reevaluating suit lifetime and inspection procedures. The mass loss and visible physical changes of each test sample was determined. Kapton control samples and data from previous asher and flight tests were used to scale the results to reflect ionospheric conditions at about 220 km altitude. It is predicted that the orthofabric loses mass in the ionosphere at a rate of about 66% of the original orthofabric mass/yr. The outer layer of the two-layer orthofabric test samples shows few easily visible signs of degradation, even when observed at 440X. It is concluded that the orthofabric could suffer significant loss of performance after much less than a year of total exposure time, while the degradation might be undetectable in post flight visual examinations of space suits. E.A.K.

N86-13900*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HUMAN FACTORS IN SPACE STATION ARCHITECTURE 1: SPACE STATION PROGRAM IMPLICATIONS FOR HUMAN FACTORS RESEARCH
Marc M. Cohen Oct. 1985 13 p refs
(NASA-TM-86702; Rept-85167; NAS 1.15:86702) Avail: NTIS HC A02/MF A01 CSCL 05H

The space station program is based on a set of premises on mission requirements and the operational capabilities of the space shuttle. These premises will influence the human behavioral factors and conditions on board the space station. These include: launch in the STS Orbiter payload bay, orbital characteristics, power supply, microgravity environment, autonomy from the ground, crew make-up and organization, distributed command control, safety, and logistics resupply. The most immediate design impacts of these premises will be upon the architectural organization and internal environment of the space station. E.A.K.

N86-13901# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INFORMATION REQUIREMENTS DETERMINATION: AN EMPIRICAL INVESTIGATION OF OBSTACLES WITHIN AN INDIVIDUAL Ph.D. Thesis
J. R. Valusek 1985 201 p
(AD-A158025; AFIT/CI/NR-85-73D) Avail: NTIS HC A10/MF A01 CSCL 05/8

This research has suggested that the requirements process be divided into two phases: IRD and IRA. There appears to be sufficient evidence to warrant additional investigation of the IRD phase using the model of inconsistency portrayed in this effort. Inconsistency appears to be a matter of perspective. From an analyst's point of view, the variation in users' needs constitutes inconsistency. From a user's point of view, the variation may be a fact of life resulting from perceptions of need that arise from a dynamic environment. This research is an initial attempt to document the requirements process from a user's perspective and to provide the user some external assistance to attempt to reduce the variation in perceptions of needs. It may be that the perceptions of needs always constitute a requirement from the individual's perspective and that the sorting of requirements from wishes must remain the responsibility of the referee. Perhaps tools oriented to both those roles: That of the user and that of the referee, are necessary. The requirements formulation scratchpad (RFS), as a prototype tool to help the user in the problem formulation phase of information requirements determination, was too complex for the research environment of this study. Based on suggestions from this initial investigation, the second generation of the RFS will be much simpler in design. GRA

N86-13902# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 1, PART A: TECHNICAL RESULTS Final Report
Robbert J. Hamann, comp. and Wim vanLeeuwen, comp. Paris ESA Feb. 1985 138 p 4 Vol.
(Contract ESA-5718/83/NL-AN(SC))
(FOK-TR-R-84-110-Vol-1-Pt-A; ESA-CR(P)-2048-Vol-1) Avail: NTIS HC A07/MF A01

A space manipulator system is defined, and the kinematics and dynamics of the system are outlined. A system with seven degrees of freedom, rotating joints, electrical actuation, a toroidal work area, and planar/rotational maneuvering is advocated. Its basic application is servicing and maintenance of low Earth orbit platforms for materials processing. The fully extended arm must be able to move a 750 kg payload at 0.02 m/sec. A dedicated programming system must be defined for collision and obstacle avoidance. Author (ESA)

N86-13903# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 1, PART B: TECHNICAL RESULTS Final Report
Robbert J. Hamann, comp. and Wim vanLeeuwen, comp. Paris ESA Feb. 1985 247 p refs 4 Vol.
(Contract ESA-5718/83/NL-AN(SC))
(FOK-TR-R-84-110-Vol-1-Pt-B; ESA-CR(P)-2048-Vol-2) Avail: NTIS HC A11/MF A01

Control aspects of robots for maintenance and servicing of low Earth orbit materials processing platforms were studied. Electrical architecture and software organization were analyzed. Work required to develop the robot was identified. Active force feedback control is advocated. Author (ESA)

N86-13904# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 2: TECHNICAL APPENDICES Final Report
Robbert J. Hamann, comp. and Wim vanLeeuwen, comp. Paris ESA Feb. 1985 121 p 4 Vol.
(Contract ESA-5718/83/NL-AN(SC))
(FOK-TR-R-84-110-Vol-2; ESA-CR(P)-2048-Vol-3) Avail: NTIS HC A06/MF A01

Forward and inverse kinematics of a robot manipulator system for maintenance and servicing of space platforms; software availability; robot languages; control models and plots; coupling and decoupling; and modeling errors are summarized. Author (ESA)

N86-13905# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
STUDY ON DESIGN TECHNIQUES FOR ROBOTS (SPACE APPLICATIONS). VOLUME 3: EXECUTIVE SUMMARY Final Report
Robbert J. Hamann, comp. and Wim vanLeeuwen, comp. Paris ESA Feb. 1985 44 p ref 4 Vol.
(Contract ESA-5718/83/NL-AN(SC))
(FOK-TR-R-84-110-Vol-3; ESA-CR(P)-2048-Vol-4) Avail: NTIS HC A03/MF A01

A space manipulator system is defined, and the kinematics and dynamics of the system are outlined. A system with seven degrees of freedom, rotating joints, electrical actuation, a toroidal work area, and planar/rotational maneuvering is advocated. Its basic application is servicing and maintenance of low Earth Orbit platforms for materials processing. The fully extended arm must be able to move a 750 kg payload at 0.02 m/sec. A dedicated programming system must be defined for collision and obstacle avoidance. Control aspects; electrical architecture; and software organization were analyzed. Work required to develop the robot was identified. Active force feedback control is advocated. Author (ESA)

N86-13906# Purdue Univ., West Lafayette, Ind.
ALERTED MONITORS: HUMAN OPERATORS AIDED BY AUTOMATED DETECTORS Final Report
R. D. Sorkin and D. E. Robinson Dec. 1984 55 p
(Contract DTRS56-83-C-00047)
(PB85-222750; DOT/OST/P34-85/021) Avail: NTIS HC A04/MF A01 CSCL 05H

In an alerted monitor system, an automated detector assists a human operator in the detection and diagnosis of problems occurring in some monitored process. Air traffic control centers and the flight decks of commercial aircraft include many examples of such systems. This project developed a general model of the altered-monitor system and evaluated the effects on system performance of interactions between the human operator and automated detector. One of the types of interaction evaluated (contingent criterion strategy) yields optimal performance from the combined person-machine system. Two laboratory experiments were performed to evaluate the assumptions of the model and the interactions between the operator and automated components. GRA

N86-14091*# Missouri Univ., Columbia. Dept. of Chemical Engineering.
SOLID WASTE TREATMENT PROCESSES FOR SPACE STATION Final Report
Thomas R. Marrero *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 55 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06K

N86-14160# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL LIFE-SUPPORT SYSTEMS FOR LONG-DURATION SPACE FLIGHTS
I. Andreyev and Yevgeniy Yakovlevich Shepelev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 71-74 Transl. into ENGLISH from Izv. (Moscow), 11 Feb. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14161# Joint Publications Research Service, Arlington, Va.
ARCHITECT DISCUSSES SPACE HABITAT DESIGNS
S. Zigunenko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 75-77 Transl. into ENGLISH from Pravda (Moscow), 4 Dec. 1984 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N86-13907*# Space Telescope Science Inst., Baltimore, Md.
A REPORT ON THE ST ScI OPTICAL DISK WORKSTATION
6 Nov. 1985 12 p
(Contract NASw-3783)
(NASA-CR-176369; NAS 1.26:176369) Avail: NTIS HC A02/MF A01 CSCL 09B

The STScI optical disk project was designed to explore the options, opportunities and problems presented by the optical disk technology, and to see if optical disks are a viable, and inexpensive, means of storing the large amount of data which are found in astronomical digital imagery. A separate workstation was purchased on which the development can be done and serves as an astronomical image processing computer, incorporating the optical disks into the solution of standard image processing tasks. It is indicated that small workstations can be powerful tools for image processing, and that astronomical image processing may be more conveniently and cost-effectively performed on microcomputers than on the mainframe and super-minicomputers. The optical disks provide unique capabilities in data storage. E.A.K.

N86-13908# Royal Signals and Radar Establishment, Malvern (England).
SAFE CONTROL SYSTEMS AND THE VIPER MICROPROCESSOR
J. Kershaw Mar. 1985 21 p
(AD-A156617; RSRE-MEMO-3805; DRIC-BR-96082) Avail: NTIS HC A02/MF A01 CSCL 09/2

Most accidents are caused by human error. Computer control systems in aircraft, chemical plant, nuclear reactors and so on could in principle prevent many accidents, but in practice they are not reliable enough to be put in charge of human lives. This Memorandum describes some of the developments in computer hardware and software which are needed before this situation can change, and introduces the VIPER microprocessor which has been designed specifically for ultra-reliable systems. Author (GRA)

N86-13909# Michigan Univ., Ann Arbor. Supercomputer Algorithm Research Lab.
SPARSE ELIMINATION ON VECTOR MULTIPROCESSORS Interim Report, 1 Nov. 1984 - 1 Apr. 1985
D. A. Calahan 16 Apr. 1985 7 p
(Grant AF-AFOSR-0096-84)
(AD-A158274; AFOSR-85-0542TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Studies of microtasking with up to 16 CRAY X-MP processors for LU decomposition of dense systems of equations have given rise to hybrid algorithms. One issue addressed has been the problem of memory bank conflicts, which increases with the number of processors. Conflict resistant algorithms have been developed. It is possible to assembly-code the X-MP so that accesses are pre-fetched into vector registers. Several reports have been prepared recently under this effort, and a paper entitled Task Granularity Studies in a Many-Processor Cray X-MP has been accepted for publication in Parallel Computing. GRA

N86-13910# Maryland Univ., College Park. Center for Automation Research.
TARGET TRACKING BASED SCENE ANALYSIS
N. Kazor Aug. 1984 57 p
(Contract DAAK70-83-K-0018; DARPA Order 3206)
(AD-A158629; CAR-TR-88; CS-TR-1437) Avail: NTIS HC A04/MF A01 CSCL 09/4

Target Tracking and Scene Analysis are two research areas in Computer Vision which, in the past, have been dealt with as separate problems. Most target tracking systems have the relatively modest goal of detecting and identifying moving objects and tracking them, using prediction and correlation techniques, as long as they move unobscured across the field of view. Most of these systems have been developed with a set of stringent real time constraints which, given current hardware technology, constrains them to employ a set of computationally simple algorithms. Most scene analysis/segmentation systems analyze a given scene based on the static properties of objects such as shape/structure and texture, where the class of objects are generally predefined. These systems tend to be slow whenever the scene is complex, containing many objects. There are advantages to combining the two problems into one. This paper is based on such and idea is concerned with the design of an Intelligent Target Tracking System (ITTS). This experimental system tracks targets based not only on models for targets (shape, motion, etc.), but also on models of the environment through which the targets navigate and of the sensing system(s) employed to acquire the time-varying images on which the analysis is based. The ITTS is composed of a number of processes which can be divided into three processing stages: target recognition, segmentation of time-varying images, and scene model generation. GRA

N86-13911# MacDonald, Dettwiler and Associates Ltd., Richmond (British Columbia). Data Handling and Signal Processing Div.
THE CONSTRUCTION AND TESTING OF A REAL-TIME DIGITAL BREADBOARD PROCESSOR FOR THE ESA REMOTE SENSING SATELLITE SYNTHETIC APERATURE RADAR Final Report
R. W. Okkes and J. C. Degrave Paris ESA Dec. 1984 113 p
(Contract ESA-4739/81/NL-HP)
(Rept-00-0778; ESA-CR(P)-2047) Avail: NTIS HC A06/MF A01

A laboratory model, high-speed, Synthetic Aperture Radar (SAR) breadboard processor was developed to prove the feasibility of real-time processing of C-Band satellite SAR data. A Programmable Signal Processing Element (PSPE) was designed, utilizing vector level data driven control. Two PSPEs in parallel achieve a computation rate of $>$ 100 million operations/sec. A parameter control structure was developed using a distributed hierarchical architecture based on a network of commercial microcomputers. The hierarchical structure allows processing parameters to be computed in real time, and passed to the PSPEs in linked lists so that the signal processing operations are not impeded by control calculations. Speed tests demonstrate that the breadboard can process ERS-1 data in real time, and image quality tests show that the fidelity of the processor is very close to that obtained with low-speed, precision, software processors. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-13912# Argonne National Lab., Ill. Mathematics and Computer Science Div.
GRAPH THEORETIC APPROACHES TO DIAGNOSTICS: APPLICATIONS OF LOGIC PROGRAMMING AND CUTSET THEORY TO ASPECTS OF REACTOR AND CIRCUIT ANALYSIS
S. M. Ehrlich, J. R. Gabriel, A. Gonen, and L. Kuchnir Jan. 1985 42 p refs
(Contract W-31-109-eng-38)
(ANL-84-74) Avail: NTIS HC A03/MF A01

Logic programming approaches are described to two graph theoretical problems relevant to reactor and logic circuit analysis: those of cutset verification and subsystem detection. In a graph representation of a system involving components and their interconnections, sets of arcs that divide the graph into two disconnected subgraphs are termed cutsets. Two Prolog programs were developed. The first verifies that a given cutset is, indeed, a cutset (i.e., that there are no sneak paths between the two subgraphs maintaining connectivity). The second detects

possible subsystems of a device, thus simplifying the task of fault diagnosis. Author

N86-13913*# Informatics General Corp., Palo Alto, Calif.
CROSSREF FOR THE CRAY
Clayton J. Guest Nov. 1985 77 p
(Contract NAS2-11555)
(NASA-CR-177384; NAS 1.26:177384; TN-84-7104-101-12) Avail: NTIS HC A05/MF A01 CSCL 09B

Crossref for the Cray is a tool used to obtain information about the contents of a library generated with a BUILD statement under COS. It produces a list of all modules in the library; a summary table by modules containing module size, ENTRY POINTS, referenced COMMONs, and required EXTERNALs; a list of unsatisfied EXTERNALs; a summary table of ENTRY POINTS and optionally EXTERNALs; a list of COMMONs; a table of statistics and a table of contents. The output can be formatted to 8 1/2 inch vertical paper or CRT display. Author

N86-13914# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE SIMULATION OF TRUCK MOTIONS
L. D. Reid and M. A. Nahon Sep. 1985 117 p refs Sponsored in part by Ontario Ministry of Transportation and Communications
(UTIAS-294; ISSN-0082-5255) Avail: NTIS HC A06/MF A01

A study was carried out to evaluate the ability of a simulator facility to represent the motion environment experienced by a truck driver while performing typical driving maneuvers. Software was developed to command simulator motions in response to a truck model computer program. Measurements of translational acceleration and rotational velocity generated by the simulator's motion drive system were obtained. The predicted driver motion sensations in the truck and in the simulator were generated by a vestibular model and were compared with favorable results. Author

N86-13915*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. Dept. of Electrical and Computer Engineering.
PARALLEL COMPUTATION WITH THE FORCE Final Report
Harry F. Jordan (Colorado Univ.) Oct. 1985 14 p refs Submitted for publication
(Contract NAS1-17070; Grant AF-AFOSR-1089-85)
(NASA-CR-177999; ICASE-85-45; NAS 1.26:177999) Avail: NTIS HC A02/MF A01 CSCL 09B

A methodology, called the force, supports the construction of programs to be executed in parallel by a force of processes. The number of processes in the force is unspecified, but potentially very large. The force idea is embodied in a set of macros which produce multiproceossor FORTRAN code and has been studied on two shared memory multiprocessors of fairly different character. The method has simplified the writing of highly parallel programs within a limited class of parallel algorithms and is being extended to cover a broader class. The individual parallel constructs which comprise the force methodology are discussed. Of central concern are their semantics, implementation on different architectures and performance implications. Author

N86-13916*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIENCES WITH CRAY MULTI-TASKING
E. N. Miya Nov. 1985 25 p refs
(NASA-TM-88200; A-85424; NAS 1.15:88200) Avail: NTIS HC A02/MF A01 CSCL 09B

The issues involved in modifying an existing code for multitasking is explored. They include Cray extensions to FORTRAN, an examination of the application code under study, designing workable modifications, specific code modifications to the VAX and Cray versions, performance, and efficiency results. The finished product is a faster, fully synchronous, parallel version of the original program. A production program is partitioned by hand to run on two CPUs. Loop splitting multitasks three key subroutines. Simply dividing subroutine data and control structure down the middle of a subroutine is not safe. Simple division produces results that are inconsistent with uniprocessor runs. The safest way to partition the code is to transfer one block of loops at a time and check the results of each on a test case. Other issues include debugging and performance. Task startup and maintenance (e.g., synchronization) are potentially expensive. Author

N86-13917*# Vought Corp., Dallas, Tex.
COMPUTER PROGRAM FOR PREDICTION OF FUEL CONSUMPTION STATISTICAL DATA FOR AN UPPER STAGE THREE-AXES STABILIZED ON-OFF CONTROL SYSTEM
Nov. 1982 126 p refs
(Contract NAS1-15000)
(NASA-CR-166031; NAS 1.26:166031) Avail: NTIS HC A07/MF A01 CSCL 09B

A FORTRAN coded computer program and method to predict the reaction control fuel consumption statistics for a three axis stabilized rocket vehicle upper stage is described. A Monte Carlo approach is used which is more efficient by using closed form estimates of impulses. The effects of rocket motor thrust misalignment, static unbalance, aerodynamic disturbances, and deviations in trajectory, mass properties and control system characteristics are included. This routine can be applied to many types of on-off reaction controlled vehicles. The pseudorandom number generation and statistical analyses subroutines including the output histograms can be used for other Monte Carlo analyses problems. E.A.K.

N86-13918*# Vought Corp., Dallas, Tex.
COMPUTER PROGRAM FOR POST-FLIGHT ANALYSIS OF RIGID BODY MOMENTS ACTING ON A LAUNCH VEHICLE FIRST STAGE
R. N. Knauber Nov. 1982 177 p refs
(Contract NAS1-15000)
(NASA-CR-166033; NAS 1.26:166033) Avail: NTIS HC A09/MF A01 CSCL 09B

A FORTRAN coded computer program and method for evaluation of the rigid body disturbing moments for a launch vehicle first stage based on post-flight measurements is described. The technique is a straightforward deterministic approach. Residual moments are computed to satisfy the equations of motion. Residuals are expressed in terms of altered vehicle characteristics; the aerodynamic coefficients, thrust misalignment, and control effectiveness. This method was used on the Scout launch vehicle and uncovered several significant differences between flight data and wind tunnel data. The computer program is written in FORTRAN IV for a CDC CYBER 173 computer system. E.A.K.

N86-13919*# Vought Corp., Dallas, Tex.
SCOUT TRAJECTORY ERROR PROPAGATION COMPUTER PROGRAM
T. R. Myler Nov. 1982 78 p refs
(Contract NAS1-15000)
(NASA-CR-166030; NAS 1.26:166030; Rept-2-53030/1R-52776) Avail: NTIS HC A05/MF A01 CSCL 09B

Since 1969, flight experience has been used as the basis for predicting Scout orbital accuracy. The data used for calculating the accuracy consists of errors in the trajectory parameters (altitude, velocity, etc.) at stage burnout as observed on Scout flights. Approximately 50 sets of errors are used in Monte Carlo analysis to generate error statistics in the trajectory parameters. A covariance matrix is formed which may be propagated in time. The mechanization of this process resulted in computer program Scout Trajectory Error Propagation (STEP) and is described herein. Computer program STEP may be used in conjunction with the Statistical Orbital Analysis Routine to generate accuracy in the orbit parameters (apogee, perigee, inclination, etc.) based upon flight experience. Author

N86-13920*# Vought Corp., Dallas, Tex.
COMPUTER PROGRAM FOR POST-FLIGHT EVALUATION OF THE CONTROL SURFACE RESPONSE FOR AN ATTITUDE CONTROLLED MISSILE
R. N. Knauber Nov. 1982 69 p
(Contract NAS1-15000)

(NASA-CR-166032; NAS 1.26:166032) Avail: NTIS HC A04/MF A01 CSCL 09B

A FORTRAN IV coded computer program is presented for post-flight analysis of a missile's control surface response. It includes preprocessing of digitized telemetry data for time lags, biases, non-linear calibration changes and filtering. Measurements include autopilot attitude rate and displacement gyro output and four control surface deflections. Simple first order lags are assumed for the pitch, yaw and roll axes of control. Each actuator is also assumed to be represented by a first order lag. Mixing of pitch, yaw and roll commands to four control surfaces is assumed. A pseudo-inverse technique is used to obtain the pitch, yaw and roll components from the four measured deflections. This program has been used for over 10 years on the NASA/SCOUT launch vehicle for post-flight analysis and was helpful in detecting incipient actuator stall due to excessive hinge moments. The program is currently set up for a CDC CYBER 175 computer system. It requires 34K words of memory and contains 675 cards. A sample problem presented herein including the optional plotting requires eleven (11) seconds of central processor time. Author

N86-13921*# Vought Corp., Dallas, Tex.
COMPUTER PROGRAM FOR POST-FLIGHT EVALUATION OF A LAUNCH VEHICLE UPPER-STAGE ON-OFF REACTION CONTROL SYSTEM
R. N. Knauber Nov. 1982 78 p
(Contract NAS1-15000)
(NASA-CR-166029; NAS 1.26:166029) Avail: NTIS HC A05/MF A01 CSCL 09B

This report describes a FORTRAN IV coded computer program for post-flight evaluation of a launch vehicle upper stage on-off reaction control system. Aerodynamic and thrust misalignment disturbances are computed as well as the total disturbing moments in pitch, yaw, and roll. Effective thrust misalignment angle time histories of the rocket booster motor are calculated. Disturbing moments are integrated and used to estimate the required control system total inpulse. Effective control system specific inpulse is computed for the boost and coast phases using measured control fuel useage. This method has been used for more than fifteen years for analyzing the NASA Scout launch vehicle second and third-stage reaction control system performance. The computer program is set up in FORTRAN IV for a CDC CYBER 175 system. With slight modification it can be used on other machines having a FORTRAN compiler. The program has optional CALCOMP plotting output. With this option the program requires 19K words of memory and has 786 cards. Running time on a CDC CYBER 175 system is less than three (3) seconds for a typical problem. Author

N86-13922*# Stanford Univ., Calif. Computer Systems Lab.
DEVELOPMENT OF A FLIGHT SOFTWARE TESTING METHODOLOGY Final Report
Edward J. McCluskey and Dorothy M. Andrews Sep. 1985 29 p refs
(Grant NAG2-246)
(NASA-CR-176391; NAS 1.26:176391) Avail: NTIS HC A03/MF A01 CSCL 09B

The research to develop a testing methodology for flight software is described. An experiment was conducted in using assertions to dynamically test digital flight control software. The experiment showed that 87% of typical errors introduced into the program would be detected by assertions. Detailed analysis of the test data showed that the number of assertions needed to detect those errors could be reduced to a minimal set. The analysis also revealed that the most effective assertions tested program parameters that provided greater indirect (collateral) testing of other parameters. In addition, a prototype watchdog task system was built to evaluate the effectiveness of executing assertions in parallel by using the multitasking features of Ada. Author

N86-13923*# Lockheed Missiles and Space Co., Huntsville, Ala. Computational Mechanics Section.
HIGH-ALTITUDE PLUME COMPUTER CODE DEVELOPMENT Final Report
Beverly J. Audeh and Jesse E. Murphy 1 Jul. 1985 28 p refs
(Contract NAS8-34970)
(NASA-CR-171600; NAS 1.26:171600; LMSC-HEC-TR-F042501) Avail: NTIS HC A03/MF A01 CSCL 09B

The flowfield codes that have been developed to predict rocket motor plumes at high altitude were used to predict plume properties for the RCS motor which show reasonable agreement with experimental data. A systematic technique was established for the calculation of high altitude plumes. The communication of data between the computer codes was standardized. It is recommended that these outlined procedures be more completed, documented and updated as the plume methodology is applied to the varied problems of plume flow and plume impingement encountered by space station design and operation. Author

N86-13924# Naval Surface Weapons Center, Silver Spring, Md.
BOSS: A FORTRAN CODE FOR A RELATIONAL DATABASE MANAGER Final Report
E. Winston 1 May 1985 95 p
(AD-A157067; NSWC/TR-85-56) Avail: NTIS HC A05/MF A01 CSCL 09/2

The report contains documentation for a FORTRAN implementation of a relational database manager. Because the code is written in a high-level language, it is basically transportable to any computer with FORTRAN capability (minor modification may be required for compatibility with a host computer's operating system and compiler). The work was required by U31 to support computer studies requiring the extensive use of minefield planning codes. Author

N86-13925# Department of the Army, Washington, D. C.
ROUTING METHOD IN COMPUTER AIDED CUSTOMIZATION OF A TWO LEVEL AUTOMATED UNIVERSAL ARRAY Patent Application
D. C. Smith and R. Noto, inventors (to Army) 2 Jul. 1985 56 p
(AD-D011808; US-Patent-Appl-SN-751339) Avail: NTIS HC A04/MF A01 CSCL 09/5

This patent application pertains to a routing method implemented in the stored programs of a digital computer which is programmably operated to generate the wire interconnect masks for a two level metallization automated universal array having undefined roadbeds between rows of cells comprised of identical semiconductor device basic units which are further interconnected to provide a particular integrated circuit structure. Conductor routing is provided by a computer aided design system that, among other things, carries out a route analysis process which determines in which roadbed each wire should be tentatively routed in conjunction with generating a routing density profile for minimizing congestion for a particular circuit design, when the roadbed density is exceeded, certain wires are removed under a set of criteria for routing by a pathfinder routing process. Following route analysis, detailed routing and rerouting is performed sequentially by a direct routing process, a greedy channel routing process, and a pathfinder routing process with rerouting being performed after each channel router and pathfinding process. Furthermore, the greedy channel routing process makes a single pass from left to right in all wires which cross successive points simultaneously and, if necessary, deleting a wire or wires which are then rerouted by the pathfinding process. GRA

N86-13926# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
REPLICATION AND FAULT-TOLERANCE IN THE ISIS SYSTEM
K. P. Birman Mar. 1985 22 p
(Contract MDA903-85-C-0124; ARPA Order 5378)
(AD-A157775; TR-85-668) Avail: NTIS HC A02/MF A01 CSCL 09/2

The ISIS project seeks to automate the transformation of fault-intolerant program specifications into fault-tolerant implementations. The ISIS system transforms abstract type specifications into fault-tolerant implementations, while insulating both programmers and users from the mechanisms used to achieve fault-

tolerance. This paper discusses techniques for fault-tolerant implementation of a specification, methods for achieving improved performance using highly concurrent implementations, and constraints that these place on the ISIS architecture. The performance of an initial version of ISIS is then reviewed. GRA

N86-13927# Advanced Engineering Lab., Adelaide (Australia).
METCUT: A COMPUTER AIDED SYSTEM FOR MACHINING TECHNOLOGY
L. H. S. Luong and R. W. Aitchison Apr. 1985 28 p
(AD-A157941; AEL-0244-TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes a package of computer programs which has been developed for providing appropriate cutting data for a number of machining applications. The whole package was written in BASIC and can be run on PDP 11 computers running under RSTS operating systems. At present the package can provide cutting data for 9 operations, namely turning, face milling, end milling peripheral, end milling slotting, drilling, tapping, boring, part off and form tools and threading. Operations can be added or deleted from the package as desired. This package is also linked to TKDRAW which is an AEL developed CAD/CAM package for turned components. The package has also been implemented on a DATA GENERAL MV4000 computer, running under a AOS/VS operating system, at the Regency Park Community College. The recommended cutting conditions for the various operations, based on the Machining Data Handbook, represent a tool life of approximately one to two hours of cutting time for most of the common alloys when using high speed steel tools. A tool life of 30 to 60 minutes is applicable for indexable-insert carbide tools. GRA

N86-13928# Electronics Research Lab., Adelaide (Australia).
DIESS: A PROLOG IMPLEMENTATION OF A DOMAIN-INDEPENDENT EXPERT SYSTEM SHELL
R. F. Dancer May 1985 40 p
(AD-A158014; ERL-0330-TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

A software environment suitable for the expression of expert knowledge in a variety of domains has been designed and implemented in the Prolog computer language. This shell is intended to be capable of containing expert systems whose object is the proof of goal symbols in domains of categorical single-valued facts. An example is given of a non-trivial expert system to programme in the IBM Job Control Language. Some conclusions are reached and recommendation given for future developments. GRA

N86-13929# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A REACTIVE LEARNING ENVIRONMENT FOR THE EQUIPMENT PROBLEM SOLVING TECHNIQUES (EPST) SYSTEM M.S. Thesis
D. G. McKenney Aug. 1985 73 p
(AD-A158035; AFIT/CI/NR-85-68T) Avail: NTIS HC A04/MF A01 CSCL 05/9

This thesis describes a user-friendly program that allows students to troubleshoot equipment in a reactive learning environment. The system allows students to develop problem solving strategies while troubleshooting faulty equipment through the use of video scenes with graphic overlays. The student interface contains instructional strategies which access information stored in a database consisting of semantic networks and frames. Student troubleshooting involves moving within equipment, changing device settings, setting up test equipment, and obtaining equipment readings. Important features of the student interface include the simulation of devices based on first order effects, the use of production rules to describe device state transitions, and the use of an emulation algorithm to ripple out device state changes. The student interface also allows users to follow wire connections, set up test equipment, record hypotheses, and get on-line help. The student interface is general in nature. The content of the database can be changed to represent any type of equipment, but the student interface does not have to be redeveloped or modified for the new database. GRA

N86-13930# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
A NEW LIBRARY OF SUBROUTINES FOR CALCULATING SMOOTHING SPLINES
D. Hally Jun. 1985 74 p
(AD-A158049; DREA-TM-85/205) Avail: NTIS HC A04/MF A01 CSCL 09/2

Defense Research Establishment Atlantic has, at present, two libraries containing subroutines for calculating splines: IMSL and BSPLIN. A new library has been developed to supplement the IMSL and BSPLIN routines in the realm of smoothing splines. It is not self-contained, making frequent use of subroutines from the BSPLIN library. The new subroutines offer several advantages over the smoothing spline subroutines in the IMSL and BSPLIN libraries: (1) the order of the spline may be picked by the user; (2) the second derivative of the spline is not constrainted to be zero at its end-points; (3) the user of the new subroutines has freedom to choose the number and positions of the knots of the spline; and (4) the new subroutines have, as input, an extra set of weights, delta sub i, i= 1,N, which control the stiffness of the spline between each pair of knots. The new subroutines were initially developed for use in ship hull approximation for the calculation of boundary layer growth on the hull. For this calculation one needs splines whose second derivatives are very well behaved. The additional control afforded by the new subroutines makes them far more suitable for this application than any of the subroutines makes them far more for this application than any of the subroutines currently available in either the IMSL or BSPLIN libraries. GRA

N86-13931# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ALGORITHM TO TRANSLATE RELATIONAL ALGEBRA QUERIES INTO QUEL M.S. Thesis
D. F. Blumenthal May 1985 82 p
(AD-A158169; AFIT/CI/NR-85-57T) Avail: NTIS HC A05/MF A01 CSCL 09/2

The work presented in this thesis deals with the development of an algorithm required to translate queries from IMDAS' (Integrated Manufacturing Data Administration System) intermediate representation, relational algebra, into QUEL, the query language of the INGRES subsystem. The algorithm for translating relational algebra query trees into QUEL is used to process queries in a distributed, heterogeneous data base management system used to support computer integrated manufacturing. A node-by-node translation algorithm, as well as an optimal algorithm which uses minimization techniques is presented. A general discussion about implementation is also included. GRA

N86-13932# Colorado School of Mines, Golden. Center for Wave Phenomena.
PRE-STACK KIRCHHOFF INVERSION OF COMMON OFFSET DATA
M. F. Sullivan and J. K. Cohen 4 Jun. 1985 58 p
(Contract N00014-84-K-0049)
(AD-A158205; CWP-027) Avail: NTIS HC A04/MF A01 CSCL 09/2

A pre-stack inversion algorithm is developed for acoustic Kirchhoff, high frequency, common offset data. Given the velocity above a reflector, the interface is located and an angularly-dependent reflection coefficient is computed at each reflection point. A quick post-processing step then calculates the velocity of the lower medium. Lateral velocity variations in the second layer are naturally recovered since each reflection point provides an independent measure of the reflection coefficient. The inversion is performed as a mapping where the response to subsurface test points is examined by an integration over the data. If a test point is on the reflector, the reflection coefficient is returned. Inversion and migration operators both utilize an integral over the data, with each trace in the summation weighted by an amplitude and a phase term. The Kirchhoff offset inversion is first formulated for data acquired over a plane, producing a 3-D reflectivity map.

Since data are commonly collected along a single line, a 2.5-D specialization is also developed. A method for determining the velocity of the lower medium from an angularly-dependent reflection coefficient is then detailed for the 2. GRA

N86-13933# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
ON THE COMPLEXITY OF ID/LP PARSING
G. E. Barton, Jr. Dec. 1984 25 p
(Contract N00014-80-C-0505)
(AD-A158211; AI-M-812) Avail: NTIS HC A02/MF A01 CSCL 09/2

Recent linguistic theories cast surface complexity as the result of interacting subsystems of constraints. For instance, the ID/LP grammar formalism separates constraints on immediate dominance from those on linear order, Shieber (1983) has shown how to carry our direct parsing of ID/LP grammars. His algorithm uses ID and LP constraints directly in language processing, without expanding them into a context-free object grammar. This report examines the computational difficulty of ID/LP parsing; the worst-case runtime of his algorithm is exponential in grammar size. A reduction of the vortex-cover problem proves that ID/LP parsing is NP-complete. The growth of internal data structures is the source of difficulty in Shieber's algorithm. The computational and linguistic implications of these results are discussed. Despite the potential for combinatorial explosion, Shieber's algorithm remains better than the alternative of parsing an expanded object grammar. GRA

N86-13934# Stanford Univ., Calif. Systems Optimization Lab.
ON PROJECTED NEWTON BARRIER METHODS FOR LINEAR PROGRAMMING AND AN EQUIVALENCE TO KARMARKAR'S PROJECTIVE METHOD
P. E. Gill, W. Murray, M. A. Saunders, J. A. Tomlin, and M. H. Wright Jul. 1985 27 p
(Contracts N00014-85-K-0343; DAAG29-84-K-0156; DE-AM03-76SF-00326; DE-AT03-76ER-72018; Grants NCF DCR-84-13211; NCF ECS-83-12142)
(AD-A158212; DE85-015096; SU-SOL-85-11; ARO-21592.6-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

The authors discuss interior-point methods for linear programming derived by applying a logarithmic barrier transformation and performing projected Newton steps for a sequence of barrier parameters. Under certain conditions, one of these projected Newton barrier methods is shown to be equivalent to Karmarkar's (1984) projective method for linear programming. Details are given of a specific barrier algorithm and its practical implementation. Numerical results are given for several nontrivial test problems. Author (GRA)

N86-13935# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
Ada AS A HARDWARE DESCRIPTION LANGUAGE: AN INITIAL REPORT
M. R. Barbacci, S. Grout, G. Lindstrom, M. Maloney, and E. Organick 8 Dec. 1984 36 p
(Contract F33615-81-K-1539; DARPA Order 4305)
(AD-A158217; CMU-CS-85-104) Avail: NTIS HC A03/MF A01 CSCL 09/3

This paper reports on our initial results in using Ada as a Hardware Description Language. Ada provides abstraction mechanisms to support the development of large software systems. Separate compilation as well as nesting of packages, tasks, and subprograms allow the construction of modular systems communicating through well defined interfaces. The complexity of modern chips (e.g., those proposed in the VHSIC program) will require the use of those features that make Ada a good language for programming-in-the-large. The key to our approach is establishing a writing style appropriate to the objective of describing both the behavior and the structure of hardware components. We model a hardware system as an ensemble of typed objects, where each object is an instance of an abstract data type. The type definition and the associated operations are encapsulated by a corresponding package. In this paper we illustrate our approach through a series of examples, building up a hypothetical hierarchy of hardware components. We conclude by discussing ways to describe arbitrarily complex simulation models and synthesis styles. GRA

N86-13936# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
ISSUES TO BE CONSIDERED IN THE EVALUATION OF TECHNICAL PROPOSALS FROM THE Ada (TRADEMARK) LANGUAGE PERSPECTIVE Final Technical Report
V. L. Castor 10 Jun. 1985 26 p
(AD-A158376; AFWAL-TR-85-1100) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report identifies issues for consideration in the assessment of technical proposals that are submitted in response to a Request For Proposal (RFP) which specifies the use of Ada. Detailed questions are provided on the following five main technical proposal elements; (1) methodology; (2) program design language; (3) implementation language; (4) environment; and (5) personnel. Methodology identifies issues associated with the assessment of the methodology which is proposed for accomplishing the software life cycle tasks specified within the RFP Statement of Work. Program design language identifies issues associated with the assessment of the Ada-based PDL which is proposed for accomplishing the software design tasks specified within the RFP Statement of Work. Implementation language identifies issues associated with the assessment of Ada as the implementation language, as well as the associated Ada compiler and run time support environment which are proposed for accomplishing the software development tasks specified within the RFP Statement of Work. Environment identifies issues associated with the assessment of the programming support environment which is proposed for accomplishing all of the tasks specified within the RFP Statement of Work. Personnel identifies issues associated with the assessment of the qualification of personnel proposed for accomplishing all of the tasks specified within the RFP Statement of Work. Primary emphasis is given to the level of expertise and training associated with each individual with regard to methodologies, Ada-based PDLs, Ada programming, and programming support environments. GRA

N86-13937# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
DESCRIBING SURFACES
M. Brady, J. Ponce, A. Yuille, and H. Asada Jan. 1985 35 p
(Contracts N00014-80-C-0505; N00014-77-C-0389)
(AD-A158940; AI-M-822) Avail: NTIS HC A03/MF A01 CSCL 09/4

This paper continues our work on visual representations of three-dimensional surfaces. The theoretical component is a study of classes of surface curves as a source of constraint on the surface on which they lie, and as a basis for describing it. We analyze bounding contours, surface intersections, lines of curvature, and asymptotes. Our experimental work investigates whether the information suggested by our theoretical study can be computed reliably and efficiently. We demonstrate algorithms that compute lines of curvature of a (Gaussian smoothed) surface; determine planar patches and umbilic regions; extract axes of surfaces of revolution and tube surfaces. We report preliminary results on adapting the curvature primal sketch algorithms of Asada and Brady (1984) to detect and describe surface intersections. GRA

N86-13938# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT AND ENHANCEMENT OF COMPUTER PERFORMANCE MODELING TOOL (CPMT) M.S. Thesis
J. G. Duarte Jun. 1985 118 p
(AD-A159003) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Computer Performance Modeling Tool (CPMT) is a queueing network simulator to be used in support of Computer Performance and Evaluation courses like CS4400. This thesis is a continuation of the CPMT development project and consists of adaptive and perfective maintenance work to modify the existing simulator to add extended modeling capability and to improve the simulator performance. The thesis effort also included rewriting

the CPMT user's manual to reflect new features, establishing a change log for the program and continuing validation of the simulator. GRA

N86-13939# Department of the Navy, Washington, D. C.
COMPUTER-AIDED PROCESS FOR GENERATING CAMERA-READY GRAPHICAL ARTWORK Patent Application
M. J. Caddy, inventor (to Navy) Filed 1 Sep. 1983 47 p
(AD-D011884; US-Patent-Appl-SN-528710) Avail: NTIS HC A03/MF A01 CSCL 09/2

A computer-aided process is disclosed for automatically generating a camera-ready hardcopy of a graphical plot upon command instructions imputted via a conventional storage tube graphics display terminal having an addressable cross-hair cursor and a keyboard. In accordance with an interactive graphics code or program, tabular data coordinates stored in computer file form are retrieved and plotted on appropriately titled and scaled axes with the plotted coordinates being interconnected along curves formed of a smooth or linear nature by interpolation. The graphical plot viewed on the display terminal is further enhanced by inclusion of labels, shaded areas, and reference symbols and characters prior to printing out the hardcopy of an associated hardcopy unit coupled to the display terminal. GRA

N86-13940# Lawrence Livermore National Lab., Calif.
INNER/OUTER ITERATIVE METHODS AND NUMERICAL SCHWARZ ALGORITHMS - 2
G. Rodrique and P. Saylor May 1985 41 p Presented at the IBM Conf. on Vector and Parallel Computations for Sci. Computing, Rome, 28 May 1985 Prepared in cooperation with Illinois Univ., Chicago
(Contract W-7405-eng-48)
(DE85-013197; UCRL-92077-2; CONF-8505157-1) Avail: NTIS HC A03/MF A01

Variants of the numerical Schwarz algorithms for solving elliptic partial differential equations on multiprocessing systems are described and analyzed. The methods are described in terms of domain decomposition techniques and mathematically cast into an inner/outer matrix iteration form. It is shown that under certain matrix nonnegativity conditions that the convergence rate of the global iteration is invariant to the amount of overlap of the subdomains when one inner iteration is taken. DOE

N86-13941# Lawrence Livermore National Lab., Calif.
LTSSCLI: AN ITSS SHELL FOR NLTSS, VERSION 2.0, REVISION 1
D. S. Fisher 10 May 1985 74 p
(Contract W-7405-eng-48)
(DE85-013234; UCID-19896-Rev-1) Avail: NTIS HC A04/MF A01

The LTSS Shell provides an environment within the NLTSS system for the execution of ITSS programs. LTSS programs that make system requests through BASELIB can be reloaded with the Shell compatible library. NBASELIB, to make equivalent requests to the LTSS Shell. The Shell provides a terminal view of NLTSS that closely resembles LTSS, and maps the structure of the LTSS filing system onto the NLTSS directory system. DOE

N86-13942# General Electric Co., Whetstone (England). Mechanical Engineering Lab.
INVESTIGATION OF TECHNIQUES FOR IMPROVING SPACECRAFT THERMAL CONTROL SOFTWARE Final Report
P. E. Newley and N. J. Stock Paris ESA Feb. 1985 188 p refs
(Contract ESA-5670/83/NL-PB)
(GEC-MEL42.0552; ESA-CR(P)-2044) Avail: NTIS HC A09/MF A01

Techniques for improving thermal analysis software in the automatic calculation of conductances and the interpolation of node temperatures were investigated. An approach that links conductance calculation and the interpolation scheme was developed. It involves the creation of a fine mesh of nodes for use in calculating conductance, capacitance and radiative exchange. The number of nodes to be analyzed is then reduced by Gaussian elimination. The reduction process defines an interpolation scheme which enables temperatures at nodes on the fine mesh to be calculated, linear interpolation being used at points in between. Author (ESA)

N86-13943# Ressult, Research and Consulting, Soechtenau (West Germany).
AN ALGORITHM FOR SIMULTANEOUS DETERMINATION OF MODAL FREQUENCIES AND MODAL VECTORS OF A DYNAMIC IMPEDANCE MATRIX
Paris ESA 1985 12 p
(Contract ESA-5619/83/NL-PP)
(ESA-CR(P)-2055) Avail: NTIS HC A02/MF A01

An iteration routine was installed in a distributed element package for dynamic analysis of spacecraft structures. The iteration routine determines simultaneously the eigenvalues and related eigenvectors of a dynamic stiffness matrix given in implicit form, i.e., containing poles. Unlike other routines with the same objective, the routine does not need an a priori knowledge of the poles of the matrix and it works also for gyroscopic and/or nonconservative systems. The installed version, however, is specialized to conservative and nongyroscopic systems. The main intention of this installation is to test the routine in a real world environment in order to decide on its use for nonconservative systems. Test runs are satisfactory, except if poles and zeros of the system are very close, when the scaling of the eigenvectors is poor. Author (ESA)

N86-14103*# Mississippi Valley State Univ., Itta Bena.
FORTRAN PLOTTING SUBROUTINES FOR THE SPACE PLASMA LABORATORY Final Report
Raymond Williams *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 8 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 09B

N86-14104*# Bradley Univ., Peoria, Ill. Dept. of Mathematics.
COMPUTER GRAPHICS APPLICATIONS TO CREW DISPLAYS Final Report
Joan Wyzkoski *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 10 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N86-13944*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE MISSION ORIENTED TERMINAL AREA SIMULATION FACILITY
Jack T. Kaylor, Harold I. Simmons, Patricia B. Naftel (Research Triangle Inst.), Jacob A. Houck, and Randall D. Grove Oct. 1985 63 p refs
(NASA-TM-87621; NAS 1.15:87621) Avail: NTIS HC A04/MF A01 CSCL 09B

The Mission Oriented Terminal Area Simulation (MOTAS) was developed to provide an ATC environment in which flight management and flight operations research studies can be conducted with a high degree of realism. This facility provides a flexible and comprehensive simulation of the airborne, ground-based and communication aspects of the airport terminal area environment. Major elements of the simulation are: an airport terminal area environment model, two air traffic controller stations, several aircraft models and simulator cockpits, four pseudo pilot stations, and a realistic air-ground communications network. MOTAS has been used for one study with the DC-9 simulator and a series of data link studies are planned in the near future. Author

N86-13945# Stanford Univ., Calif.
TECHNIQUES FOR THE DESIGN AND IMPLEMENTATION OF HIGHLY RELIABLE MULTI-PROCESSING SYSTEMS Annual Report, 30 Sep. 1984 - 1 Aug. 1985
D. C. Luckham 10 May 1985 7 p
(Grant AF-AFOSR-0355-83)
(AD-A159236; AFOSR-85-0693TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

During this research period several significant accomplishments were obtained. The completion of implementation of a prototype runtime monitor for detecting deadness errors in Ada tasking was accomplished. The work on runtime monitoring for deadness errors was presented at the IEEE Ada Conference in October 1984, and an invited publication appeared in IEEE Software in March 1985. A new language, called TSL (for Task Sequencing Language) to be used for specifying Ada tasking behavior, was designed and presented at the International Ada Conference in May 1985.
Author (GRA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N86-13946*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A METHOD TO STABILIZE LINEAR SYSTEMS USING EIGENVALUE GRADIENT INFORMATION
Carol D. Wieseman Nov. 1985 40 p refs
(NASA-TP-2479; L-15964; NAS 1.60:2479) Avail: NTIS HC A03/MF A01 CSCL 09B

Formal optimization methods and eigenvalue gradient information are used to develop a stabilizing control law for a closed loop linear system that is initially unstable. The method was originally formulated by using direct, constrained optimization methods with the constraints being the real parts of the eigenvalues. However, because of problems in trying to achieve stabilizing control laws, the problem was reformulated to be solved differently. The method described uses the Davidon-Fletcher-Powell minimization technique to solve an indirect, constrained minimization problem in which the performance index is the Kreisselmeier-Steinhauser function of the real parts of all the eigenvalues. The method is applied successfully to solve two different problems: the determination of a fourth-order control law stabilizes a single-input single-output active flutter suppression system and the determination of a second-order control law for a multi-input multi-output lateral-directional flight control system. Various sets of design variables and initial starting points were chosen to show the robustness of the method. Author

N86-13947*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN AND IMPLEMENTATION OF A COMPLIANT ROBOT WITH FORCE FEEDBACK AND STRATEGY PLANNING SOFTWARE
Timothy Premack, Franklin M. Strempek, Leonard A. Solis, Steven S. Brodd, Edwin P. Cutler, and Lloyd R. Purves 29 May 1984 99 p refs
(Contract NAS5-28200)
(NASA-TM-86111; NAS 1.15:86111) Avail: NTIS HC A05/MF A01 CSCL 09B

Force-feedback robotics techniques are being developed for automated precision assembly and servicing of NASA space flight equipment. Design and implementation of a prototype robot which provides compliance and monitors forces is in progress. Computer software to specify assembly steps and makes force feedback adjustments during assembly are coded and tested for three generically different precision mating problems. A model program demonstrates that a suitably autonomous robot can plan its own strategy. Author

N86-13948# Maryland Univ., College Park. Center for Automation Research.
MULTIRESOLUTION PATH PLANNING FOR MOBILE ROBOTS
S. Kambhampati and L. S. Davis May 1985 46 p
(Contract DAAK70-83-K-0018)
(AD-A158630; CAR-TR-127; CS-TR-1507) Avail: NTIS HC A03/MF A01 CSCL 09/2

The problem of automatic collision-free path planning is central to mobile robot applications. This report presents an approach to automatic two dimensional path planning based on a quadtree representation. (A quadtree is a recursive decomposition of a 2-D picture into uniformly colored sub i X 2 sub i blocks). The authors introduce hierarchical path searching methods, which make use of this multiresolution representation, to speed up the path planning process considerably. Finally, we discuss the applicability of this approach to mobile robot path planning. GRA

N86-13949# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
MOBILE ROBOT LOCALIZATION USING SONAR
M. Drumheller Jan. 1985 27 p
(Contracts N00014-80-C-0505; N00014-82-K-0334)
(AD-A158819; AI-M-826) Avail: NTIS HC A03/MF A01 CSCL 17/7

This paper describes a method by which range data from a sonar or other type of rangefinder can be used to determine the 2-dimensional position and orientation of a mobile robot inside a room. The plan of the room is modeled as a list of segments indicating the positions of walls. The method works by extracting straight segments from the range data and examining all hypotheses about pairings between the segments and walls in the model of the room. Inconsistent pairings are discarded efficiently by using local constraints based on distances between walls, angles between walls, and ranges between walls along their normal vectors. These constraints are used to obtain a small set of possible positions, which is further pruned using a test for physical consistency. The approach is extremely tolerant of noise and clutter. Transient objects such as furniture and people need not be included in the room model, and very noisy, low-resolution sensors can be used. The algorithm's performance is demonstrated using a Polaroid Ultrasonic Rangefinder, which is a low-resolution, high-noise sensor. GRA

N86-13950# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
DETERMINISTIC PARSING AND LINGUISTIC EXPLANATION: REVISION
R. C. Berwick and A. S. Weinberg Jun. 1985 36 p
(Contract N00014-80-C-0505)
(AD-A159233; AI-M-836Rev) Avail: NTIS HC A03/MF A01 CSCL 05/7

This article summarizes and extends recent results linking deterministic parsing to observed locality principles in syntax. It also argues that grammatical theories based on explicit phrase structure rules are unlikely to provide comparable explanations of why natural languages are built the way they are. GRA

N86-13951# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Psychology.
DISCOVERING QUALITATIVE EMPIRICAL LAWS Interim Report, Jan. - Jun. 1985
P. Langley, H. A. Simon, J. M. Zytkow, and D. H. Fisher 15 Jul. 1985 23 p Prepared in cooperation with California Univ., Irvine and Wichita State Univ., Kas.
(Contract N00014-84-K-0345)
(AD-A159235; TR-85-18; TR-2) Avail: NTIS HC A02/MF A01 CSCL 06/4

The process of scientific discovery is a complex interplay of many activities, ranging from the discovery of empirical laws through the construction of structural models to explain those laws. This paper focuses on the discovery of qualitative empirical laws and concepts. The authors primary examples come from the history of chemistry, and their model of the qualitative discovery process is

an AI system named GLAUBER. After describing the system and providing some examples of its operation in the domain of chemistry, they consider GLAUBER's relation to some other AI discovery systems that operate on the tasks of conceptual clustering and language acquisition. Given a set of observations, GLAUBER defines abstract classes and formulates laws stated in terms of these classes. The authors approach was driven by examples from the history of early chemistry specifically by the development of the theory of acids and bases. Although the existing version of GLAUBER covers many of these discoveries, it has numerous limitations that should be remedied in future versions of the system. These include the need for improved evaluation methods, the ability to distinguish between unobserved and unsuccessful reactions, and the ability to run simple experiments in order to test predictions. These improvements suggest the need for two additional revisions - methods for the incremental discovery of classes and laws, and a search organization more robust than the current hill-climbing scheme. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-13952# Oak Ridge National Lab., Tenn. Mathematics and Statistics Research Section.
THE FORMULATION OF A HYPERBOLIC STEFAN PROBLEM
A. D. Solomon, V. Alexiades, D. G. Wilson, and J. Drake Oct. 1984 26 p refs
(Contract DE-AC05-84OR-21400)
(ORNL-6065) Avail: NTIS HC A03/MF A01

The study of phase change processes governed by hyperbolic heat transfer is at an embryonic stage. Some of the relevant questions are raised and some remarks are made on the formulation and qualitative behavior of a hyperbolic Stefan problem. In particular, an error is corrected in the interface condition appearing in the literature, an explicit solution is presented to a simple one phase problem and its behavior studied. An enthalpy (weak) formulation for a two phase problem is described and a number of numerical experiments based on it are reported. Author

N86-13953*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPECTRAL METHODS FOR DISCONTINUOUS PROBLEMS Final Report
Saul Abarbanel (Tel-Aviv Univ.), David Gottlieb (Tel-Aviv Univ.), and Eitan Tadmor (Tel-Aviv Univ.) Aug. 1985 32 p refs Submitted for publication
(Contract NAS1-17070; Grants AF-AFOSR-0089-83; NSF DMS-85-03294; DAAG29-85-K-0190)
(NASA-CR-177974; ICASE-85-38; NAS 1.26:177974) Avail: NTIS HC A03/MF A01 CSCL 12A

Spectral methods yield high-order accuracy even when applied to problems with discontinuities, though not in the sense of pointwise accuracy. Two different procedures are presented which recover pointwise accurate approximations from the spectral calculations. Author

N86-13954*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACCURACY OF SCHEMES WITH NONUNIFORM MESHES FOR COMPRESSIBLE FLUID FLOWS Final Report
Eli Turkel (Tel-Aviv Univ.) Sep. 1985 50 p refs Submitted for publication
(Contract NAS1-17070)
(NASA-CR-177988; ICASE-85-43; NAS 1.26:177988) Avail: NTIS HC A03/MF A01 CSCL 12A

The accuracy of the space discretization for time-dependent problems when a nonuniform mesh is used is considered. Many schemes reduce to first-order accuracy while a popular finite volume scheme is even inconsistent for general grids. This accuracy is based on physical variables. However, when accuracy is measured in computational variables then second-order accuracy can be obtained. This is meaningful only if the mesh accurately reflects the properties of the solution. In addition, the stability properties of some improved accurate schemes are analyzed and it can be shown that they also allow for larger time steps when Runge-Kutta type methods are used to advance in time. Author

N86-13955*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIGRID SOLUTIONS TO QUASI-ELLIPTIC SCHEMES Final Report
Achi Brandt (Weizmann Inst. of Science, Rehovot, Israel) and Shlomo Taasan May 1985 23 p refs
(Contract NAS1-17070; Grant AF-AFOSR-0070-84)
(NASA-CR-177973; ICASE-85-26; NAS 1.26:177973) Avail: NTIS HC A02/MF A01 CSCL 12A

Quasi-elliptic schemes arise from central differencing or finite element discretization of elliptic systems with odd order derivatives on non-staggered grids. They are somewhat unstable and less accurate then corresponding staggered-grid schemes. When usual multigrid solvers are applied to them, the asymptotic algebraic convergence is necessarily slow. Nevertheless, it is shown by mode analyses and numerical experiments that the usual FMG algorithm is very efficient in solving quasi-elliptic equations to the level of truncation errors. Also, a new type of multigrid algorithm is presented, mode analyzed and tested, for which even the asymptotic algebraic convergence is fast. The essence of that algorithm is applicable to other kinds of problems, including highly indefinite ones. Author

N86-13956*# Old Dominion Univ., Norfolk, Va.
MINIMAL NORM CONSTRAINED INTERPOLATION Ph.D. Thesis
Larry Dean Irvine Sep. 1985 107 p refs
(Grant NAG1-363)
(NASA-CR-178001; NAS 1.26:178001) Avail: NTIS HC A06/MF A01 CSCL 12A

In computational fluid dynamics and in CAD/CAM, a physical boundary is usually known only discreetly and most often must be approximated. An acceptable approximation preserves the salient features of the data such as convexity and concavity. In this dissertation, a smooth interpolant which is locally concave where the data are concave and is locally convex where the data are convex is described. The interpolant is found by posing and solving a minimization problem whose solution is a piecewise cubic polynomial. The problem is solved indirectly by using the Peano Kernal theorem to recast it into an equivalent minimization problem having the second derivative of the interpolant as the solution. This approach leads to the solution of a nonlinear system of equations. It is shown that Newton's method is an exceptionally attractive and efficient method for solving the nonlinear system of equations. Examples of shape-preserving interpolants, as well as convergence results obtained by using Newton's method are also shown. A FORTRAN program to compute these interpolants is listed. The problem of computing the interpolant of minimal norm from a convex cone in a normal dual space is also discussed. An extension of de Boor's work on minimal norm unconstrained interpolation is presented. Author

N86-13957*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STABLE BOUNDARY CONDITIONS AND DIFFERENCE SCHEMES FOR NAVIER-STOKES EQUATIONS Final Report
Pravir Dutt Aug. 1985 90 p refs
(Contract NAS1-17070; Grant NAG1-506)
(NASA-CR-177984; ICASE-85-37; NAS 1.26:177984) Avail: NTIS HC A05/MF A01 CSCL 12A

The Navier-Stokes equations can be viewed as an incompletely elliptic perturbation of the Euler equations. By using the entropy function for the Euler equations as a measure of energy for the Navier-Stokes equations, it was possible to obtain nonlinear energy estimates for the mixed initial boundary value problem. These

estimates are used to derive boundary conditions which guarantee L2 boundedness even when the Reynolds number tends to infinity. Finally, a new difference scheme for modelling the Navier-Stokes equations in multidimensions for which it is possible to obtain discrete energy estimates exactly analogous to those we obtained for the differential equation was proposed. Author

N86-13958*# Mills Coll., Oakland, Calif. Math/Science Network.
EXPANDING YOUR HORIZONS IN SCIENCE AND MATHEMATICS Final Report
1985 11 p
(Grant NAG2-335)
(NASA-CR-176372; NAS 1.26:176372) Avail: NTIS HC A02/MF A01 CSCL 12A

Through the presentation of its Expanding Your Horizons in Science and Mathematics career education conferences for secondary school young women, the Math/Science Network continues its efforts to remove the educational, psychological, and cultural barriers which prevent women from entering math-and science-based careers. The Expanding Your Horizons conferences were presented on 77 college, university and high school campuses across the United States. This year, these unique one day conferences reached 15,500 students, 3,000 parents and educators, and involved 3,000 career women who volunteered their services as conference planners, workshop leaders, speakers, and role models. Author

N86-13959*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PARAMETER IDENTIFICATION FOR A ROBOTIC MANIPULATOR ARM Final Report
D. W. Brewer and J. S. Gibson Sep. 1985 26 p refs
(Contract NAS1-17070)
(NASA-CR-178002; ICASE-85-42; NAS 1.26:178002) Avail: NTIS HC A03/MF A01 CSCL 12A

The development is described of a nonlinear dynamic model for large oscillations of a robotic manipulator arm about a single joint. Optimization routines are formulated and implemented for the identification of electrical and physical parameters from dynamic data taken from an industrial robot arm. Special attention is given to the role of sensitivity in the formulation of robust models of this motion. The importance of actuator effects in the reduction of sensitivity is established and used to develop an electromechanical model of the manipulator system. Author

N86-13960# Stanford Univ., Calif. Dept. of Statistics.
A BEHAVIORAL SUMMARY FOR COMPLETELY RANDOM NETS
A. E. Gelfand 20 Jun. 1985 22 p
(Contract N00014-76-C-0475)
(AD-A157755; TR-359) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper characterizes the cycle structure of a completely random net. Variables such as number of cycles of a specified length, number of cycles, number of cyclic states and length of cycle are studied. A square array of indicator variables enables convenient study of moment structure. Additionally, exact and asymptotic distributional results are presented. Author (GRA)

N86-13961# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
FURTHER RESULTS FOR APPLICATION OF DISTURBANCE MINIMIZATION CONTROL TECHNIQUES TO A LINEAR, TIME-INVARIANT, SECOND-ORDER STATE SET-POINT REGULATOR PROBLEM
W. L. McCowan 10 Oct. 1984 58 p
(AD-A157793; AD-E950711; AMSMI/RG-85-5-TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Further results on The Application of Disturbance Minimizing Control Design Techniques to a linear, time-invariant state set-point regulator are presented using a second-order system as an example. A comparison is presented of performance obtained from a controller designed to minimize steady-state error versus one designed to minimize disturbance effects on error dynamics. Two examples are presented to illustrate regions of positive and negative disturbance utility. It is also shown that control energy expenditure can be reduced if use is made of external disturbances. Author (GRA)

N86-13962# Wisconsin Univ., Madison. Mathematics Research Center.
DECAY WITH A RATE FOR NONCOMPACTLY SUPPORTED SOLUTIONS OF CONSERVATION LAWS Technical Summary Report
B. Temple Jun. 1985 66 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-82-10950)
(AD-A158163; MRC-TSR-2831) Avail: NTIS HC A04/MF A01 CSCL 12/1

This document shows that solutions of the Cauchy problem for systems of two conservation laws decay in the supnorm at a rate that depends only on the L sub 1 norm of the initial data. This implies that the dissipation due to the entropy dominates the nonlinearities in the problem at a rate depending only on the L sub 1 norm of the initial data. The main estimate requires an analysis of approximate characteristics for its proof. A general framework is developed for the study of approximate characteristics, and the main estimate is obtained for an arbitrary number of equations. GRA

N86-13963# Wisconsin Univ., Madison. Mathematics Research Center.
ADAPTIVE, SELF-VALIDATING NUMERICAL QUADRATURE Technical Summary Report
G. F. Corliss and L. B. Rall May 1985 42 p
(Contract DAAG29-80-C-0041)
(AD-A158164; MRC-TSR-2815) Avail: NTIS HC A03/MF A01 CSCL 12/1

Integrals of a function of a single variable can be expressed as the sum of a numerical quadrature rule and a remainder term. The quadrature rule is a linear combination of function values and weights, or the integral of a Taylor polynomial, while the remainder term depends on some derivative of the integrand evaluated at an unknown point in the interval of integration. Numerical quadrature is made self-validating by using interval computation to capture both the roundoff and truncation errors made when using a given rule. Necessary derivatives can be generated automatically by using well-known recurrence relations for Taylor coefficients. In order for quadrature methods of this type to be accurate and efficient an accurate scalar product and an adaptive strategy are required. The necessary scalar product and support for interval arithmetic are provided in PASCAL-SC (for microcomputers) and ACRITH (for IBM 370 computers). The adaptive strategy chooses the subintervals of integration and the order of the quadrature formula used in each subinterval on the basis of guaranteed, rather than estimated, information about the error of the numerical integration in each subinterval. The program described implements standard Newton-Cotes, Gaussian, and Taylor series methods for numerical intergration. Ways to handle singularities are discussed, and comparisons are given with a standard numerical integration method. Author (GRA)

N86-13964# Wisconsin Univ., Madison. Mathematics Research Center.
CONVERGENCE OF CARDINAL SERIES Technical Summary Report
C. DEBoor, K. Hoellig, and S. Riemenschneider Jun. 1985 9 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-83-51187)
(AD-A158166; MRC-TSR-2834) Avail: NTIS HC A02/MF A01 CSCL 12/1

The result of this paper is a generalization of an characterization of the limits of multivariate cardinal splines. GRA

N86-13965# Wisconsin Univ., Madison. Mathematics Research Center.
BOUNDARY INTEGRAL TECHNIQUES FOR MULTI-

CONNECTED DOMAINS Technical Summary Report
G. R. Baker and M. J. Shelley Jun. 1985 40 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-83-02549)
(AD-A158171; MRC-TSR-2830) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several boundary integral techniques are available for the computation of the solution to Lapace's equation in multi-connected domains. However, for cases where the domain is changing, such as in incompressible, inviscid fluid flow with free surfaces, iterative methods are highly attractive. The paper describes one such formulation and tests it on circular and elliptic annuli. It is necessary to use interpolated numerical quadrature points to maintain accuracy when regions on the annuli are thin. Author (GRA)

N86-13966# Wisconsin Univ., Madison. Mathematics Research Center.
UNIFORMLY HIGH-ORDER ACCURATE NON-OSCILLATORY SCHEMES 1 Technical Summary Report
A. Harten and S. Osher May 1985 60 p
(Contract DAAG29-80-C-0041)
(AD-A158177; MRC-TSR-2823) Avail: NTIS HC A04/MF A01 CSCL 12/1

The authors begin the construction and the analysis of nonoscillatory shock capturing methods for the approximation of hyperbolic conservation laws. These schemes share many desirable properties with total variation diminishing schemes, but TVD schemes have at most first order accuracy, in the sense of truncation error, at extrema of the solution. This paper constructs a uniformly second order approximation, which is nonoscillatory in the sense that the number of extrema of the discrete solution is not increasing in time. This is achieved via a nonoscillatory piecewise linear reconstruction of the solution form its cell averages, time evolution through an approximate solution of the resulting initial value problem, and averaging of this approximate solution over each cell. Author (GRA)

N86-13967# Wisconsin Univ., Madison. Mathematics Research Center.
A LINEAR COMBINATION TEST FOR DETECTING SERIAL CORRELATION IN MULTIVARIATE SAMPLES Technical Summary Report
R. A. Johnson and T. Langeland Jun. 1985 23 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-82-02205)
(AD-A158179; MRC-TSR-2825) Avail: NTIS HC A02/MF A01 CSCL 12/1

This document proposes a test for detecting serial dependence among multivariate observations. The test statistic is the maximum absolute value of the lag 1 correlation obtainable from a linear combination of the observations. The authors express the statistic in terms of two eigenvalues and then obtain the asymptotic null distribution. Asymptotic power is examined for sequences of local alternatives in a multivariate normal autoregressive process. An explicit expression is obtained for the density of the limit distribution in the bivariate case. They then compare power with the likelihood ratio statistic. Author (GRA)

N86-13968# Liverpool Univ. (England). Dept. of Statistics and Computational Mathematics.
PRACTICAL ASPECTS OF FUNCTIONAL TESTING TECHNIQUES Final Technical Report, 17 Sep. 1981 - 16 Jan. 1985
M. A. Hennell, M. U. Shaikh, S. Presland, and P. Fairfield 31 Jan. 1985 141 p
(Contract DAJA37-81-C-0736; DA Proj. 1T1-61102-BH-57)
(AD-A158184) Avail: NTIS HC A07/MF A01 CSCL 09/2

This document reports an investigation into the processes involved in functional testing. The objective was to determine criteria by means of which the process can be quantified and hence controlled. The report demonstrates that insufficient knowledge about functionality exists for general metrics to be constructed. Indeed it clearly indicates that any method dependent on a knowledge of functionality is unlikely, except in special application areas, to be successful. GRA

N86-13969# Maryland Univ., College Park. Inst. for Physical Science and Technology.
BASIC PRINCIPLES OF FEEDBACK AND ADAPTIVE APPROACHES IN THE FINITE ELEMENT METHOD Final Report
I. Babuska and W. Gui Jul. 1985 30 p
(Contract N00014-85-K-0169; Grant NSF DMS-83-15216)
(AD-A158188; BN-1042) Avail: NTIS HC A03/MF A01 CSCL 12/1

The notion of feedback and adaptivity in numerical computations has attracted great attention in recent years. All the modern ODE's solvers for initial value problems and quadratures are feedback methods. The feedback methods are increasingly in the focus of interest in the area of numerical solution of PDE and computational mechanics. Many reports, preprints and papers dealing with the adaptivity appeared recently. It seems to be that successful computation of today's large complex problems cannot be made without some kind of feedback or adaptive approach. This paper addresses the basic notions of the theory of feedback and adaptive finite element methods. An illustrative example of the finite element method for solving nonlinear differential equation of the elliptic type is presented. Numerical example of regridding process is given. GRA

N86-13970# Wisconsin Univ., Madison. Mathematics Research Center.
COMPUTABLE BOUNDS FOR SOLUTIONS OF INTEGRAL EQUATIONS Technical Summary Report
L. B. Rall May 1985 17 p
(Contract DAAG29-80-C-0041)
(AD-A158189; MRC-TSR-2816) Avail: NTIS HC A02/MF A01 CSCL 12/1

Interval integration is used to obtain inclusions of integral operators of the form g(u)(s) = integral of T(g(s,t,u(s),u(t))dt) which can be carried out on a computer. The resulting inclusions, combined with interval iteration, are used to compute guaranteed upper and lower bounds for solutions of integral equations of the form u = g(u) for s is an element of S. It is also possible to establish existence or nonexistence of solutions of integral equations in given regions on the basis of results of the computation. Examples of applications of this technique to linear and nonlinear integral equations are eigenvalue problems for linear integral operators are given. GRA

N86-13971# Maryland Univ., College Park. Lab. for Numerical Analysis.
THE h-p VERSION OF THE FINITE ELEMENT METHOD Final Report
I. Babuska and B. Guo Jul. 1985 89 p
(Contract N00014-85-K-0169; Grant NSF DMS-83-15216)
(AD-A158194; BN-1043) Avail: NTIS HC A05/MF A01 CSCL 12/1

The paper analyzes the h-p version of the finite element method in two dimensions. It proves that the error of the method measured in the energy norm decreases exponentially. Extensive computational analysis with the code PROBE, shows the practical effectivity of the h-p version, and the applicability of the theoretical asymptotic error estimates in the range of engineering computations and accuracy. GRA

N86-13972# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON ASYMPTOTIC DISTRIBUTION OF THE TEST STATISTIC FOR THE MEAN OF THE NONISOTROPIC PRINCIPAL COMPONENT
C. Fang and P. R. Krishnaiah May 1985 16 p
(Contract F49620-85-C-0008)
(AD-A158255; TR-85-20; AFOSR-85-0551TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Data analysts are often confronted with the problem of large dimensional data. In some of these situations, it is customary to reduce the dimensionality of the problem by using principal component analysis and to perform statistical analysis of the data using the new variables (principal components). For example, the

new variables are used in the area of classification. Chestnut and Floyd (1981) used the principal components as variables in identification of underwater targets. However, the statistical data analysis using the principal components is adhoc since the distributions of the test statistics based upon the principal components are complicated when the covariance matrix is unknown. Very little work was done in the literature on deriving the distributions of these test statistics even in the asymptotic case. In this paper, we derive the asymptotic distribution of the t statistic based upon the new variable (the most important principal component) instead of using any of the original variables. The above asymptotic distribution is shown to be Student's t distribution. The accuracy of the above approximation is studied by comparing the simulated values using the asymptotic expression with the standard Student's t table. It is found that the accuracy of the above approximation is sufficient for many practical situations. GRA

N86-13973# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
SPECTRA FOR LARGE DIMENSIONAL RANDOM MATRICES
Y. Q. Yin and Z. D. Bai May 1985 14 p
(Contract F49620-85-C-0008)
(AD-A158256; TR-85-17; AFOSR-85-0547TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, the authors reviewed some recent developments in the area of large dimensional random matrices. GRA

N86-13974# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
AN ALTERNATE DERIVATION OF THE DISTRIBUTION OF THE CONDITIONED SIGNAL-TO-NOISE RATIO
R. C. Hanumara May 1985 12 p
(Contract F49620-85-C-0008)
(AD-A158257; TR-85-18; AFOSR-85-0548TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

A result in multiple regression analysis is used to derive the probability distribution of the conditioned signal-to-noise ratio. Author (GRA)

N86-13975# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision.
INTRINSIC NILPOTENT APPROXIMATION
C. Rockland Jun. 1985 121 p
(Contract DAAG29-84-K-0005)
(AD-A158265; ARO-20980.28-MA) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report is a preliminary version of work on an intrinsic approximation process arising in the context of a nonisotropic perturbation theory for certain classes of linear differential and pseudodifferential operators P on a minifold M. A basic issue is that the structure of P itself determines the minimal information that the initial approximation must contain. This may vary from point to point, and requires corresponding approximate state spaces or phase spaces. This approximation process is most naturally viewed from a seemingly abstract algebraic context, namely the approximation of certain infinite dimensional filtered Lie algebras L by (finite-dimensional) graded nilpotent Lie algebras. GRA

N86-13976# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
INFERENCE ON THE RANKS OF THE CANONICAL CORRELATION MATRICES FOR ELLIPTICALLY SYMMETRIC POPULATIONS
P. R. Krishnaiah, J. Lin, and L. Wang May 1985 31 p
(Contract F49620-85-C-0008)
(AD-A158268; TR-85-14; AFOSR-85-0550TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, the authors considered the likelihood ratio tests and some other tests for the ranks of the canonical correlation matrices when the underlying distributions are real and complex elliptically symmetric distributions. Also, asymptotic joint distributions of the eigenvalues of the sample canonical correlation matrices are derived under the assumptions mentioned above regarding the underlying distributions. Finally, applications of tests for the rank of the complex canonical correlation matrix in the area of time series in the frequency domain are discussed. GRA

N86-13977# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
A NOTE ON THE INTEGRATED CAUCHY FUNCTIONAL EQUATION
A. A. Alzaid, C. R. Rao, and D. N. Shanbhag May 1985 11 p
(Contract F49620-85-C-0008)
(AD-A158269; TR-85-19; AFOSR-85-0549TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A new proof is given using de Finneti's theorem on infinite sequence of exchangeable random variables for the solution of the integrated Cauchy functional equation studied by Lau and Rao (1982) in the continuous case and by Shanbhag (1977) in the discrete case. Author (GRA)

N86-13978# Georgia Inst. of Tech., Atlanta.
PARTITIONS OF POINT PROCESSES: MULTIVARIATE POISSON APPROXIMATIONS
R. F. Serfozo May 1985 25 p
(Grant AF-AFOSR-0367-84)
(AD-A158739; AFOSR-85-0626TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This study shows that when a point process is partitioned into certain uniformly sparse subprocesses, then the subprocesses are asymptotically multivariate Poisson or compound Poisson. Bounds are given for the total-variation distance between the subprocesses and their limits. Several partitioning rules are considered including independent, Markovian, and batch assignments of points. Author (GRA)

N86-13979# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
CODON CONSTRAINTS ON CLOSED 2D SHAPES
W. A. Richards and D. D. Hoffman 1 May 1984 25 p
(Contract F49620-83-C-0135)
(AD-A158744; AI-M-769; AFOSR-85-0588TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Codons are simple primitives for describing plane curves. They thus are primarily image-based descriptors. Yet they have the power to capture important information about the 3D world, such as making part boundaries explicit. The codon description is highly redundant (useful for error-correction). This redundancy can be viewed as a constraint on the number of possible codon strings. For smooth closed strings that represent the bounding contour (silhouette) of many smooth 3D objects, the constraints are so strong that sequences containing 6 elements yield only 33 generic shapes as compared with a possible number of 15,625 combinations. An important task for object recognition is the description of the shape of a bounding contour such as a sihouette that outlines as object. Although recognition need require only partial segments of such contours, the internal canoncial description, against which the image contour is compared, is very likely a closed ring. Our concept of most objects should lead us to expect such a closed contour. The description of closed, 2D contours thus is an important ingredient of a system for object recognition. First the author present such a scheme, described in more detail elsewhere and then show how the scheme leads to a hierarchical taxonomy of closed, 2D shapes. GRA

N86-13980# Maryland Univ., College Park. Center for Automation Research.
COMPUTATION OF GEOMETRIC PROPERTIES FROM THE MEDIAL AXIS TRANSFORM IN 0 (n LOG n) TIME
A. Y. Wu, S. K. Bhaskar, and A. Rosenfeld Jun. 1985 40 p
(Contract F49620-83-C-0082)
(AD-A158934; CAR-TR-122; CS-TR-1497; AFOSR-85-0616TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The digital medial axis transfer (MAT) represents and image subset S as the union of maximal upright squares contained in S.

Brute-force algorithms for computing geometric properties of S from its MAT require time O (sq n), where n is the number of squares. Over the past few years, however, algorithms have been developed that compute properties for a union of upright rectangles in time O (n log n), which makes the use of the MAT much more attractive. This document reviews these algorithms and also present efficient algorithms for computing union-of-rectangle representations of derived sets (union, intersection, complement) and for conversion between the union of rectangles and other representations of a subset. Author (GRA)

N86-13981# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
UNIFIED METHOD FOR DELAY ANALYSIS OF RANDOM MULTIPLE ACCESS ALGORITHMS Interim Report
L. Georgiadis, L. Merakos, and P. Papantoni-Kazakos Aug. 1985 63 p
(Grant AF-AFOSR-0229-83)
(AD-A159108; UCT/DEECS/TR-85-8; AFOSR-85-0712TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper presents a unified method for the delay analysis of a large class of random multiple - access algorithms. This method is based on a powerful theorem referring to regenerative processes, in conjunction with results from the theory of infinite dimensionality linear systems. The method is applied to analyze and compute the per packet expected delays induced by three algorithms, in the presence of the Poisson user model. The considered algorithms are: The controlled ALOHA algorithm, the 0.487 algorithm, and the n-ary stack algorithm. GRA

N86-13982# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A FINITE ELEMENT SOLUTION OF THE TRANSPORT EQUATION M.S. Thesis
F. A. Tarantino Mar. 1985 196 p
(AD-A159245; AFIT/GNE/PH/85M-19) Avail: NTIS HC A09/MF A01 CSCL 12/1

Using a self adjoint form of the transport equation expressed as a variational integral, finite element equations for the one dimensional, one speed, homogeneous, time independent transport equation in slab geometry were derived and envoded in FORTRAN 77. The accuracy of C sub 0 and C sub 1 continuous fits was compared against an analytical solution for the case of noscatter. It was found that the C fits require an excessive amount of mesh refinement. The C sub 1 fit is very accurate, and does not appear to be computationally excessive. The finite element results were then compared, for the case of isotropic scatter, to a Legendre polynomial solution, and the results of a recently developed code known as Ln. The methods accuracy was sufficiently verified with inexact scattering term evaluation. A technique of exact scattering integral evaluation is proposed that should reduce the amount of refinement required for convergence, and improve computational efficiency. Author (GRA)

N86-13983# Lawrence Livermore National Lab., Calif.
CURRENT METHODS FOR LARGE STIFF ODE SYSTEMS
A. C. Hindmarsh May 1985 5 p refs Presented at the 11th Intern. Assoc. of Math. and Computers Simulation World Congr., Oslo, 5 Aug. 1985
(Contract W-7405-eng-48)
(DE85-012914; UCRL-92641; CONF-850861-3) Avail: NTIS HC A02/MF A01

Initial value problems for ODE systems are especially challenging when they are both large and stiff. Current methods range from explicit to fully implicit. Quasi-steady state, split operator, and hybrid methods are often effective, but require much problem specific setup and rarely allow for error control. General implicit methods with error control have the widest applicability. They involve an algebraic system problem, usually solved with Newton like iterations, combined with direct or iterative linear system methods, sometimes using partitioning. Research is in progress on matrix free iterations. DOE

N86-13588*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PARAMETRIC STUDY OF THE IBRAHIM TIME DOMAIN MODAL IDENTIFICATION ALGORITHM Final Report
Richard S. Pappa and Samir R. Ibrahim (Old Dominion Univ.) *In* Old Dominion Univ. Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 43-72 refs Previously announced as N83-10258 (For primary document see N86-13587 04-31)
Avail: NTIS HC A04/MF A01 CSCL 13B

N86-13590*# Old Dominion Univ., Norfolk, Va.
COMPUTATION OF NORMAL MODES FROM IDENTIFIED COMPLEX MODES Final Report
Samir R. Ibrahim *In its* Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 446-451 refs Previously announced as N82-75431 and in IAA as A83-22143 (For primary document see N86-13587 04-31)
Avail: NTIS HC 04/MF A01 CSCL 13B

N86-14079*# University of Southwestern Louisiana, Lafayette. Dept. of Mathematics and Statistics.
ESTIMATION OF FINITE MIXTURES USING THE EMPIRICAL CHARACTERISTIC FUNCTION Final Report
Charles Anderson and Thomas Boullion *In* NASA. Johnson Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1985 7 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

N86-14083*# Arkansas Univ., Little Rock.
FINITE ELEMENT OR GALERKIN TYPE SEMIDISCRETE SCHEMES Final Report
Kanat Durgun *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 14 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

N86-14099*# Houston Baptist Univ., Tex. Dept. of Mathematics and Physics.
TRANSFORMATION MATRICES BETWEEN NON-LINEAR AND LINEAR DIFFERENTIAL EQUATIONS Final Report
Robert L. Sartain *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

N86-14101*# Texas Univ., Austin. Dept. of Aerospace and Engineering.
ADVANCED ALGORITHM FOR ORBIT COMPUTATION Final Report
Victor Szenbehely *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 17 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

N86-14129# Joint Publications Research Service, Arlington, Va.
STRUCTURE OF COEFFICIENTS OF SERIES REPRESENTING SOLUTION OF PLANE CIRCULAR RESTRICTED THREE-BODY PROBLEM Abstract Only
Ye. I. Timoshkova and V. B. Titov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 38 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1211-1217 Previously announced in IAA as A85-42346 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-13984# Naval Research Lab., Washington, D. C.
DIFFERENTIAL ENTROPY AND THE STATISTICS OF INSTANTANEOUS FAILURE Memorandum Report, Mar. - Apr. 1985
A. K. Rajagopal, K. L. Ngai, and S. Teitler 23 Aug. 1985 13 p
(AD-A158047; NRL-MR-5627) Avail: NTIS HC A02/MF A01 CSCL 12/1

The dimensionless differential entropy for failure statistics is shown to be equal to unity plus the negative of the expectation of the logarithm of the hazard function. The effect of transformation of the ordering parameter on the latter due to changes in physical conditions is discussed. Author (GRA)

N86-13985# Purdue Univ., West Lafayette, Ind. School of Industrial Engineering.
DECOMPOSITION OF SOME WELL-KNOWN VARIANCE REDUCTION TECHNIQUES: REVISION
B. L. Nelson and B. W. Schmeiser May 1985 39 p Prepared in cooperation with Ohio State Univ., Columbus
(Contract N00014-79-C-0832-Rev)
(AD-A158048; RM-84-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

Proliferation of techniques and lack of unifying structure has hindered both study and application of variance reduction. The author's recently developed unifying structure, presented in detail elsewhere, is a taxonomy that views each variance reduction technique (VRT) as a transformation from one experiment to another. The taxonomy is exhaustive in that any VRT can be expressed as a composition of elemental transformations from six classes. This paper illustrates this taxonomy by using the notation, terminology, and concepts of the taxonomy to discuss seven VRTs. The objective is to use the reader's knowledge of these well-known techniques to provide an introduction and overview of the taxonomy. Author (GRA)

N86-13986# Wisconsin Univ., Madison. Mathematics Research Center.
B-SPLINES AND LINEAR COMBINATIONS OF UNIFORM ORDER STATISTICS Technical Summary Report
A. G. Ignatov and V. K. Kaishev May 1985 28 p
(Contract DAAG29-80-C-0041)
(AD-A158151; MRC-TSR-2817) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is shown in this document that the density of the sum of n independent random variables uniformly distributed on unequal intervals is given by a linear combination of n! B-splines with constant coefficients. Another useful representation of the same density is given using de Boor's definition of the discrete B-spline. It is also shown that the B-spline is the density of a linear combination of order statistics from the uniform distribution on (0,1). This interpretation of the B-spline allows one to establish easily validity of recurrence relations for densities and moments of linear combinations of order statistics as well as to state limit theorems both for B-splines and linear combinations. Examples given illustrate how asymptotic results for B-splines may be applied to linear combinations of order statistics. Using limit theorems of probability theory, two examples of Curry and Schoenberg (1966) for B-splines are derived even in somewhat greater generality. GRA

N86-13987# Wisconsin Univ., Madison. Mathematics Research Center.
APPROXIMATION OF THE INITIAL RESERVE FOR KNOWN RUIN PROBABILITIES Technical Summary Report
E. W. Frees May 1985 26 p
(Contract DAAG29-80-C-0041)
(AD-A158167; MRC-TSR-2822) Avail: NTIS HC A03/MF A01 CSCL 12/1

An important problem in the study of actual risk theory is approximating the probability of ruin within finite time based on a specified initial reserve. This paper addresses the similar, but mathematically different, problem of how to approximate a desired initial reserve given a pre-specified probability of ruin. Although the procedures have desirable asymptotic properties such as consistency and asymptotic normality, these are computer-intensive and would not have been practicable before the wide spread availability of high-speed computers. The procedures rely on simulated realizations of a general risk process. Thus, these can be used in many of the mathematical models of risk processes that appear in the literature such as the Compound Poisson, ARMA and Stochastic Discounting models. Examples of several models are given to demonstrate the versatility of the procedure and to demonstrate that the procedures are computationally feasible. Author (GRA)

N86-13988# Wisconsin Univ., Madison. Mathematics Research Center.
CONDITIONING IN A MISSING DATA PROBLEM Technical Summary Report
C. J. Skinner Jul. 1985 18 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-82-10950)
(AD-A158202; MRC-TSR-2836) Avail: NTIS HC A02/MF A01 CSCL 12/1

Observations are recorded on variables x and y but a mechanism, which may depend on the observed x values, causes some of the y values to be missing. For three parametric examples, exact or approximate ancillary statistics are constructed. Conditioning on these ancillaries enables the missing data mechanism to be ignored under certain conditions. A correspondence is shown between these conditional procedures and the use of the observed information matrix in measuring the dispersion of the maximum likelihood estimator. GRA

N86-13989# Stanford Univ., Calif. Dept. of Operations Research.
THE THEORY OF STANDARDIZED TIME SERIES
P. W. Glynn and D. L. Iglehart Apr. 1985 38 p
(Contract DAAG29-84-K-0030; Grant NSF MCS-82-3483)
(AD-A158383; TR-8; ARO-20927.8-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

Building on Schruben's work, this document has developed a general framework for the analysis of standardized time series. Under mild assumptions on the output process, the method of standardized time series produces asymptotically valid confidence intervals for steady-state parameters. However, these intervals are asymptotically larger and more variable then those steady-state intervals obtained by a method which consistently estimates the appropriate steady-state variance constant (such as the regenerative method). In this sense, standardized time series confidence intervals are asymptotically less desirable then those constructed by consistent estimation. These results do not, however, preclude the possibility that standardized times series may be superior in certain small sample context; this remains an area for future work. GRA

N86-13990# Purdue Univ., West Lafayette, Ind. School of Industrial Engineering.
MONTE CARLO ANALYSIS OF NONLINEAR STATISTICAL MODELS. 1. THEORY: REVISION
J. J. Swain and B. R. Schmeiser Aug. 1985 18 p Prepared in cooperation with Georgia Inst. of Tech., Atlanta
(Contract N00014-79-C-0832; Grant NSF ECS-82-06498)
(AD-A158613; AD-F630681; RM-85-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

Parameter values of nonlinear statistical models are typically estimated from data using iterative numerical procedures. The resulting joint sampling distribution of the parameter estimators is often intractable, resulting in the use of approximators or Monte Carlo simulation to determine properties of the sampling distribution. This paper develops methods, using linear and quadratic approximators as control variates, that reduce the variance of the Monte Carlo estimator by orders of magnitude. Estimation of means,

higher order raw moments, variances, covariances, and percentiles is considered. Author (GRA)

N86-13991# Georgia Inst. of Tech., Atlanta.
EXTREME VALUES OF QUEUES, POINT PROCESSES AND STOCHASTIC NETWORKS Research Progress Report, 30 Sep. 1984 - 15 Jun. 1985
R. F. Serfozo 25 Jun. 1985 5 p
(Grant AF-AFOSR-0367-84)
(AD-A158619; AFOSR-85-0620TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This document reports on research progress in the following topics: (1) Extreme Values of Queues - Several subtle technical problems remain to present the results in as general and natural setting as possible; (2) Extreme Values of Stochastic Networks - Work should be completed by fall. After that the emphasis will change on this topic to the following one; (3) Optimal Control of Networks of queues - This topic was not in the original proposal, but the investigators have made a breakthrough in this area that they intend to pursue; (4) Point Processes Related to Extreme Values - Several results in the convergence of certain point processes to Poisson processes have been obtained. These are documented in two papers written under this grant; and (5) Extreme Values of Point Processes - This is an area which will be developed later in the research effort. Author (GRA)

N86-13992# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
BASIC PROPERTIES OF STRONG MIXING CONDITIONS Technical Report, Sep. 1984 - Aug. 1985
R. C. Bradley Jun. 1985 41 p Prepared in cooperation with Indiana Univ., Bloomington
(Contract F49620-82-C-0009; Grant NSF DMS-84-01021)
(AD-A158740; TR-102; AFOSR-85-0619TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is a survey of te basic properties of strong mixing conditions for sequences of random variables. The focus will be on the structural properties of these conditions, and not at all on limit theory. For a discussion of central limit theorems and related results under these conditions, the reader is referred to Peligrad or Iosifescu. This survey will be divided into eight sections as follows: (1) Measures of dependence; (2) Five strong mixing conditions; (3) Mixing conditions for two or more sequences; (4) Mixing conditions for Markov chains; (5) Mixing conditions for Gaussian sequences; (6) Some other special examples; (7) The behavior of the dependence coefficients; and (8) Approximation of mixing sequences by other random sequences. Author (GRA)

N86-13993# Massachusetts Inst. of Tech., Lexington.
ADAPTIVE DETECTION IN NONSTATIONARY INTERFERENCE: PART 1 AND PART 2
E. J. Kelly 25 Jun. 1985 139 p
(Contract F19628-85-C-0002)
(AD-A158810; TR-724; ESD-TR-85-197) Avail: NTIS HC A07/MF A01 CSCL 17/9

In this report, which consists of two parts, the problem of radar target detection in a background of nonstationary external interference is considered. The object of the analysis is to treat this problem from the point of view of statistical decision theory, and to derive a signal processing algorithm which accepts the totality of inputs on which final decision is to be based, and performs both interference suppression and target detection. It is assumed that the radar is provided with multiple RF input channels and that target-free samples, from range gates other than one in which a target is being sought, can be used for the estimation of the interference statistics. In Part I a general formulation is given and a likelihood ratio detection rule is derived. GRA

N86-13994# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
METHODOLOGY FOR STOCHASTIC MODELING
H. E. Cohen Jan. 1985 43 p Supersedes GWD Interim note, G-144
(AD-A158851; AMSAA-TR-410) Avail: NTIS HC A03/MF A01 CSCL 12/1

The requirement to develop stochastic mathematical models arises across the whole range of engineering and applied research where observations are made of a physical process, corrupted by noise, and it is desired to determine the underlying nature, either in time or frequency, of the observed phenomenon. This paper presents some of the current approaches in stochastic modeling, including adaptive autoregressive models, which have been found to be useful in this area. Author (GRA)

N86-13995# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
CONTINUITY OF CERTAIN RANDOM INTEGRAL MAPPINGS AND THE UNIFORM INTEGRABILITY OF INFINITELY DIVISIBLE MEASURES
Z. J. Jurek and J. Rosinski Mar. 1985 27 p
(Contract F49620-82-C-0009)
(AD-A159105; TR-95; AFOSR-85-0684TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper it is shown that the class of probability measures L(Q), which generalizes the classical Levy class L, is homeomorphic with the class ID sub log of all infinitely divisible probability measures having finite logarithmic moment. As an application of this result a set of generators of the entire class L(Q) is described. As a necessary tool, the relationship between the uniform integrability of infinitely divisible measures and of their corresponding Levy measures is studied and this may be of independent interest. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N86-13996# Stanford Univ., Calif. Systems Optimization Lab.
EXISTENCE OF EQUILIBRIUM PRICES FOR A SIMPLE PLANNING MODEL
H. Hu Jun. 1985 13 p
(Contracts N00014-85-K-0343; DE-AM03-76SF00326)
(AD-A158263; DE85-015095; SU-SOL-85-10) Avail: NTIS HC A02/MF A01 CSCL 12/2

This is a study on linear programming with intensive use of generations. The economic interpretation of the model is given at the end of the paper. GRA

N86-13592*# Old Dominion Univ., Norfolk, Va.
TIME-DOMAIN QUASI-LINEAR IDENTIFICATION OF NON-LINEAR DYNAMIC SYSTEMS Final Report
Samir R. Ibrahim *In its* Dyn. Identification for Control of Large Space Struct. Nov. 1985 p 35-43 refs Presented at the AIAA/ASME/ASCE/AHS 24th Struct., Struct. Dyn. and Mater. Conf., Lake Tahoe, Nev., 2-4 May 1983 Previously announced in IAA as A83-29811 and A84-36495 (For primary document see N86-13587 04-31)
(AIAA-83-0811-CP) Avail: NTIS HC A04/MF A01

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-13997# Wisconsin Univ., Madison. Mathematics Research Center.
REALIZATION THEORY IN HILBERT SPACE Technical Summary Report
D. Salamon Jul. 1985 37 p
(Contract DAAG29-80-C-0041; Grant NSF DMS-82-10950)
(AD-A158172; MRC-TSR-2835) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper studies the state space representation of time

invariant causal, linear input-output operators in continuous time. A realization theorem in the Hilbert space context is established in full generality using unbounded input and output operators. The first step is to construct an abstract state space representation with a prescribed input-output behavior. The second step is to transform this abstract system into a differential equation. The uniqueness problem is discussed in some detail as well as the relation to existing results in realization theory. Author (GRA)

N86-13998# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
A VARIANT OF SHANBHAG'S LEMMA ARISING OUT OF A MODIFIED RAO-RUBBIN CONDITION
A. A. Alzaid, C. R. Rao, and D. N. Shanbhag May 1985 15 p
(Contract F49620-85-C-0008)
(AD-A158608; TR-85-22; AFOSR-85-0558TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A modified Rao-Rubbin condition for damage models gives rise to a recurrence relation which is somewhat different from that considered by Shanbhag (1977). A complete solution to the new recurrence relation is obtained and its applications are indicated. Author (GRA)

N86-13999# Florida State Univ., Tallahassee. Dept. of Statistics.
INFORMATION IN CENSORED MODELS
M. Hollander, F. Proschan, and J. Sconing Jun. 1985 25 p
(Contract F49620-85-C-0007; AF Proj. 2304)
(AD-A158644; FSU-Statistics-M701; AFOSR-85-177TR; AFOSR-85-01617TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Criteria are developed for measuring information in the randomly right-censored model. Measures which are appropriate include an extension of Shannon's entropy. The measures are seen to satisfy some fundamental theorems including: (1) the uncensored case is always at least as informative as any censored model, (2) information decreases as censoring increases stochastically, and (3) the information gain is marginally decreasing. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-14000# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PHYSICS AND TECHNOLOGY OF STRONG MAGNETIC FIELDS (CHAPTER 10)
V. R. Karasik 24 Jul. 1985 13 p Transl. into ENGLISH from the book "Fizika i Tekhnika Silnykh Magnitnykh Poley" Moscow, 1964 p 157-166
(AD-A158174; FTD-ID(RS)T-1097-84) Avail: NTIS HC A02/MF A01 CSCL 20/3

The gaseous nitrogen under high pressure enters from the cylinders into the central tube from below and squeezes the liquid (sodium-potassium alloy) from the lower tank along the ring peripheral channel upward. The liquid passes through holes in the external wall of the hydromagnet, enters into the working chamber, and through holes in the internal wall emerges into the central tube; then it is guided into the upper tank. After the basic mass of liquid is found upward, the nitrogen cylinders are disconnected, and both chambers, the upper and lower, are connected with the atmosphere. The pressure is equalized, and the liquid overflows through the special small hole back into the lower chamber. Then the cycle is repeated. GRA

N86-14001# California Univ., Berkeley. Lawrence Berkeley Lab.
MAGNETIC FIELD APPLICATIONS IN MODERN TECHNOLOGY AND MEDICINE
T. S. Tenforde May 1985 37 p refs Presented at the Symp. on Biol. Effects of Static and Extremely-Low-Frequency Magnetic Fields, Neuherberg, West Germany, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-015197; LBL-19711; CONF-8505183-1) Avail: NTIS HC A03/MF A01

A brief summary is given of several major applications of magnetism. A description of the range of magnetic field intensities to which humans are exposed in technologies that utilize large stationary magnetic fields is given. DOE

N86-14002# California Univ., Berkeley. Lawrence Berkeley Lab.
LATTICE AND BYPASS DESIGN FOR A COHERENT XUV FACILITY
A. Jackson, A. A. Garren, and G. Vignola May 1985 6 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(Contracts DE-AC02-76CH-00016; DE-AC03-76SF-00098)
(DE85-016556; LBL-19486; CONF-850504-242) Avail: NTIS HC A02/MF A01

The design of a magnet lattice and bypass for a coherent radiation facility is discussed. The lattice is the missing magnet FODO structure first proposed by Vignola for a 6 GeV light source. This has been adapted for a 750 to 1300 MeV electron storage ring for use with both conventional insertion devices and a high gain FEL optimized for output at 400 A. The latter device requires that the electron bunch be deflected into a small aperture bypass, then reinjected into the ring where the perturbing effects of the FEL are damped out. DOE

N86-14003# Stanford Linear Accelerator Center, Calif.
IRON DOMINATED MAGNETS
G. E. Fischer Jul. 1985 71 p Presented at the SLAC Summer School on the Phys. of High Energy Particle Accelerators, Stanford, Calif., 15 Jul. 1985
(Contract DE-AC03-76SF-00515)
(DE85-014955; SU-SLAC-PUB-3726; CONF-850771-1) Avail: NTIS HC A04/MF A01

These two lectures on iron dominated magnets are meant for the student of accelerator science and contain general treatments of the subjects design and construction. The material is arranged in the categories: General Concepts and Cost Considerations, Profile Configuration and Harmonics, Magnetic Measurements, a few examples of special magnets and Materials and Practices. Extensive literature is provided. DOE

N86-14004# Brookhaven National Lab., Upton, N. Y.
RANDOM ERRORS IN THE MAGNETIC FIELD COEFFICIENTS OF SUPERCONDUCTING MAGNETS
J. Herrera, R. Hogue, A. Prodell, P. Wanderer, and E. Willen 1985 7 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-012261; BNL-36629; CONF-850504-168) Avail: NTIS HC A02/MF A01

Random errors in the multipole magnetic coefficients of superconducting magnet have been of continuing interest in accelerator research. The Superconducting Super Collider (SSC) with its small magnetic aperture only emphasizes this aspect of magnet design, construction, and measurement. With this in mind, we present a magnet model which mirrors the structure of a typical superconducting magnet. By taking advantage of the basic symmetries of a dipole magnet, we use this model to fit the measured multipole rms widths. The fit parameters allow us then to predict the values of the rms multipole errors expected for the SSC dipole reference design D SSC-C5. With the aid of first-order perturbation theory, we then give an estimate of the effect of these random errors on the emittance growth of a proton beam stored in an SSC. DOE

N86-14005# Lawrence Livermore National Lab., Calif.
JASON ELECTROSTATIC BOUNDARY CONDITIONS: A SURVEY
J. M. Zentler Jun. 1985 51 p
(Contract W-7405-eng-48)
(DE85-014521; UCID-20457) Avail: NTIS HC A04/MF A01

The following is a survey of boundary conditions available to the JASON user for solving 2-D electrostatics problems. Simple examples are included for illumination. It is assumed that the reader has some familiarity with JASON terminology, such as PC and cc, and has access to the JASON user's manual. DOE

N86-13584# Aerodyne Research, Inc., Billerica, Mass.
SINGLE PARTICLE SIZING BY MEASUREMENT OF BROWNIAN MOTION Abstract Only
Alan C. Stanton and Wai K. Cheng *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-14006*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY MEASUREMENT OF THE NOISE FROM THE 2/9 SCALE MODEL OF THE LARGE-SCALE ADVANCED PROPFAN (LAP) PROPELLER, SR-7A
James H. Dittmar Sep. 1985 22 p refs
(NASA-TM-87116; E-2718; NAS 1.15:87116) Avail: NTIS HC A02/MF A01 CSCL 02A

Noise data on the Large-scale Advanced Propfan (LAP) propeller model SR-7A were taken into the NASA Lewis 8- by 6-Foot Wind Tunnel. The maximum blade passing tone decreases from the peak level when going to higher helical tip Mach numbers. This noise reduction points to the use of higher propeller speeds as a possible method to reduce airplane cabin noise while maintaining high flight speed and efficiency. Comparison of the SR-7A blade passing noise with the noise of the similarly designed SR-3 propeller shows good agreement as expected. The SR-7A propeller is slightly noisier than the SR-3 model in the plane of rotation at the cruise condition. Projections of the tunnel model data are made to the full-scale LAP propeller mounted on the test bed aircraft and compared with design predictions. The prediction method is conservative in the sense that it overpredicts the projected model data. Author

N86-14007*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME DESIGN PHILOSOPHY FOR REDUCING THE COMMUNITY NOISE OF ADVANCED COUNTER-ROTATION PROPELLERS
James H. Dittmar Aug. 1985 29 p refs
(NASA-TM-87099; E-2692; NAS 1.15:87099) Avail: NTIS HC A03/MF A01 CSCL 20A

Advanced counter-rotation propellers have been indicated as possibly generating an unacceptable amount of noise for the people living near an airport. This report has explored ways to reduce this noise level, which is treated as being caused by the interaction of the upstream propeller wakes and vortices with the downstream propeller. The noise reduction techniques fall into two categories: (1) reducing the strength of the wakes and vortices, and (2) reducing the response of the downstream blades to them. The noise from the wake interaction was indicated as being reduced by increased propeller spacing and decreased blade drag coefficient. The vortex-interaction noise could be eliminated by having the vortex pass over the tips of the downstream blade, and it could be reduced by increased spacing or decreased initial circulation. The downstream blade response could be lessened by increasing the reduced frequency parameter omega or by phasing of the response from different sections to have a mutual cancellation effect. Uneven blade to blade spacing for the downstream blading was indicated as having a possible effect on the annoyance of counter-rotation propeller noise. Although there are undoubtedly additional methods of noise reduction not covered in this report, the inclusion of the design methods discussed would potentially result in a counter-rotation propeller that is acceptably quiet. Author

N86-14008# Rensselaer Polytechnic Inst., Troy, N.Y.
RAY TRANSMISSIONS OVER A SLOPING BOTTOM IN SHALLOW WATER
M. J. Jacobson, W. L. Siegmann, and T. H. Rousseau 1 Aug. 1985 52 p
(Contract N00014-76-C-0288)
(AD-A158017; RPI-152) Avail: NTIS HC A04/MF A01 CSCL 20/1

The effects of a sloping bottom on acoustic transmissions, between a source and receiver at arbitrary but fixed locations, are investigated using ray theory. An isospeed channel is assumed, and bottom angles up to about 3 degrees are considered. Sloping bottom influence on per-ray quantities, including travel time and transmission loss, are examined for cw transmissions. Significant variations are shown to occur, such as travel time changes of more than 200 ms over ranges of about six km. Per-ray transmission loss is found to be influenced strongly by bottom slope, the amount of influence depending upon source-receiver bearing and the bottom loss model used. Variations of more than 20 dB are demonstrated. Effects of a sloping bottom on the total acoustic field are examined also, and the results compared with those for a horizontal bottom. Finally, a simple model of a shallow water front is superposed over the sloping bottom, and travel time is investigated. The sloping bottom effect can induce travel time changes more than 300% larger than the frontal effect for different source-receiver geometries and bottom inclinations. GRA

N86-14009# Tennessee Univ., Knoxville. Ultrasonics Lab.
THEORY OF THE PROPAGATION OF FINITE AMPLITUDE ULTRASONIC WAVES IN PURE MODE DIRECTIONS IN HEXAGONAL AND TRIGONAL CRYSTALS Interim Report
G. Du and M. A. Breazeale Jun. 1985 73 p
(Contract N00014-81-K-0229; NR Proj. RR0-1108)
(AD-A158154; TR-24) Avail: NTIS HC A04/MF A01 CSCL 02/2

The nonlinear theory describing the propagation of finite amplitude ultrasonic waves in pure mode directions in hexagonal and trigonal crystals is developed. By evaluating the coefficient of the term which couples the longitudinal wave of finite amplitude to the transverse modes, one finds the pure mode directions by requiring this coefficient to vanish. The result is that for hexagonal crystals the directions along the symmetry axis and in the basal plane are pure longitudinal mode directions. Pure mode directions are also found for longitudinal waves propagating tangential to a cone whose apex is centered about the symmetry axis and whose apex angle is a function of the second-order elastic constants of the sample under consideration. The third-order elastic constants which determine the magnitude of the second harmonic of an initially sinusoidal ultrasonic wave are evaluated for these additional directions. For finite amplitude longitudinal ultrasonic waves in trigonal crystals, we have specialized to nonpiezoelectric crystals and have evaluated the third-order elastic constants which determine the magnitude of the second harmonic of an initially sinusoidal wave propagating in the following pure mode directions: (1) along the symmetry axis (the c-direction); (2) along the a-direction in the basal plane; (3) along the direction in the basal plane that makes an angle of 60 deg with the a-direction; and (4) along a direction in the b-c plane whose angle with respect to the b-axis is a function of the second-order elastic constants of the crystal under consideration. GRA

N86-14010# Washington State Univ., Pullman. Dept. of Physics.
ACOUSTICAL SCATTERING FROM AN ELASTIC SPHERE IN WATER: SURFACE WAVE GLORY, RESONANCES, AND THE SOMMERFELD-WATSON TRANSFORMATION FOR AMPLITUDES
K. L. Williams Aug. 1985 74 p
(Contracts N00014-85-C-0141; N00014-80-C-0838; RR0-1108)

(AD-A158884) Avail: NTIS HC A04/MF A01 CSCL 20/1

Scattering of acoustic waves from fluid-load elastic spheres with 10 < ka < 100 (where k is the wavenumber of the acoustic wave in the liquid and a the radius of the sphere) is studied, The main emphasis is on understanding the scattered pressure near backscattering. By carrying out a Sommerfeld-Watson Transformation (SWT) it is shown that this pressure includes contributions from specular reflection, transmitted bulk waves, and surface waves. It is shown experimentally that surface wave contributions to near backscattering display a J sub o Bessel function angular dependence characteristic of weak axial focusing along the backscattered direction; i.e., glory scattering. This focusing is modeled by alternate methods which agree and complement each other. One method allows a simple picture of the glory phenomena while the others (which includes the SWT) are more mathematically rigorous. The absolute value of individual Rayleigh and whispering gallery surface wave contributions is found by this modeling. The theoretical results for are tested experimentally using the Rayleigh surface contribution to scattering from a tungsten carbide sphere. The SWT results are also used to find the far field backscattering pressure as a function of ka. These results are used to better understand and interpret the recently developed Resonance Scattering Theory (RST) as applied to acoustic scattering. It is shown that surface wave contributions to backscattering may be summed in a way analogous to the frequency response of a Fabry-Perot resonator. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-14011# Wisconsin Univ., Madison. Mathematics Research Center.

THE MATHEMATICAL STRUCTURE OF ELEMENTARY PARTICLES: 2 Technical Summary Report

P. Nowosad May 1985 102 p

(Contract DAAG29-80-C-0041)
(AD-A158191; MRC-TSR-2818) Avail: NTIS HC A06/MF A01 CSCL 20/8

This report is the second part of a general theory purporting to describe the mathematical structure of the elementary particles, deriving it from first principles. It consists of Chapters 6 and 7, continuing the MRC Technical Summary Report 2581, October 1983. These chapters study the implications of the SL sub 2 (R) transformation group of the particles geometry. Chapter 6 shows how the discrete series of representations implies the quantization of the geometries and in particular why the electron does not interact strongly. Chapter 7 obtains the resonances as states corresponding to the principal series of representations.

Author (GRA)

N86-14012# Washington State Water Research Center, Pullman.

DETERMINATION OF THE ACTIVATION BARRIER TO ENERGY TRANSFER FROM 3 pi pi* TO CHARGE TRANSFER LEVELS VIA STEADY STATE AND TRANSIENT LUMINESCENCE MEASUREMENTS ON BIS(4-CHLOROTHIOPHENOL) (1,10-PHENANTHROLINE) ZINC (II) Interim Technical Report

R. G. Highland and G. A. Crosby 1 Aug. 1985 14 p

(Contract N00014-83-K-0609)
(AD-A158239; TR-3-ONR) Avail: NTIS HC A02/MF A01 CSCL 20/8

Recent studies on mixed ligand chelates of M(II)(BS)2(N-N) M(II) = Zn(II), Cd(II); BS = anion of a substituted benzenethiol; N-N = dinitrogen-heterocycle reveal the existence of multiple level emissions originating from different electronic configurations. The 6.5 K thermally modulated emission of Zn(4-Cl-PhS)2(phen) showed that the population of the emitting levels could be redistributed via heat pulses, a result that suggested an energy barrier between two accessible excited configurations. We report here an initial investigation of the temperature-dependence of both luminescence lifetimes and intensities of Zn(4-Cl-PhS)2(phen) in an attempt to measure the activation barrier between electronic configurations of dissimilar orbital parentages. The effect of temperature on the luminescence intensity and excited state lifetimes of the title compound is interpreted in terms of a barrier to the transfer of energy from the lowest 3 Pi level to lower-lying charge-transfer levels. Fits of an Arrhenius expression to both lifetimes and relative intensities yield an activation energy and preexponential factor of approx. 140/cm and approx. 100,000/s, respectively. GRA

N86-14013# Missouri Univ., Rolla. Dept. of Physics.

METASTABLE INTERACTIONS: DISSOCIATIVE EXCITATION Final Report, Aug. 1981 - Jan. 1985

L. D. Schearer May 1985 81 p

(Contract F33615-81-K-2081)
(AD-A158733; AFWAL-TR-85-2022) Avail: NTIS HC A05/MF A01 CSCL 07/5

The work reported here is concerned with the interaction between thermal energy metastable atoms and molecules and other atoms and molecules in a beam or in a flowing afterglow. The importance of reactions involving metastable species can be traced to the relative ease with which energy can be stored in ensembles of metastable atoms and molecules and the wide variety of reactions in which they can participate. Of particular interest are those processes which involves energy transfer from the metastable system to a second species which results in excited states which fluoresce. Two principal experimental methods have been used: (1) Metastable beams crossed with a target species, (2) Fast flowing rare gas and nitrogen afterglows. A wide variety of metal halogen, Group 2 metastable beams crossed with a target species, (2) Fast flowing rare gas and nitrogen afterglows. A wide variety of metal halogen, Group 2 metals, methane and silane have been reacted with helium, argon and nitrogen metastables.

Author (GRA)

N86-14014# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

IDENTIFICATION OF NUCLEAR MATERIALS FROM REMOTE DETECTION OF CHARACTERISTIC GAMMA RAYS M.S. Thesis

L. W. Brasure Mar. 1985 149 p

(AD-A159244; AFIT/GNE/PH/85M-2) Avail: NTIS HC A07/MF A01 CSCL 18/4

This research effort studies the application of Bayes' decision theorem to extending the range of remote identification of nuclear materials. The finite element method was used to develop a radiation transport code which was used to reconstruct a group of three sample sources at distances of 50, 100, 200, 300, 400, and 500 meters. Both the Poisson and multinomial distributions were then used to simulate measured sources in a low count environment at these six ranges. Bayes' theorem was applied to the resulting measured sources to test for positive identification. The results show that a low resolution detector can increase the range of remote detection an average of 100 meters when compared with the method of photopeak identification. Bayes' theorem is unable, however, to identify sources not contained in the library of known sources. GRA

N86-14015# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANALYSIS OF THE DYNAMIC BEHAVIOR OF AN INTENSE CHARGED PARTICLE BEAM USING THE SEMIGROUP APPROACH Ph.D. Thesis

M. A. Stafford May 1985 137 p

(AD-A159247; AFIT/DS/ENC/85-1) Avail: NTIS HC A07/MF A01 CSCL 20/7

Dynamic models of a charged particle beam subject to external electromagnetic fields are cast into the abstract Cauchy problem form. Various applications of intense charged particle beams, i.e., beams whose self electromagnetic fields are significant, might require, or be enhanced by, the use of dynamic control constructed from suitably processed measurements of the state of the beam. This research provides a mathematical foundation

for future engineering development of estimation and control designs for such beams. Beginning with the Vlasov equation, successively simpler models of intense beams are presented, along with their corresponding assumptions. Expression of a model in abstract Cauchy problem form is useful in determining whether the model is well posed. Solutions of well-posed problems can be expressed in terms of a one-parameter semigroup of linear operators. (The state transition matrix for a system of linear, ordinary, first-order, constant coefficient differential equations is a special case of such a semigroup.) The semigroup point of view allows the application of the rapidly maturing modern control theory of infinite-dimensional systems. An appropriate underlying Banach space is identified for a simple, but non-trivial, single degree of freedom model (the electrostatic approximation model), and the associated one-parameter semigroup of linear operators is characterized. Author (GRA)

N86-14016# Los Alamos National Lab., N. Mex.
SCHEME TO FUNNEL ION BEAMS WITH A RADIO-FREQUENCY QUADRUPOLE
R. H. Stokes and G. N. Minerbo 1985 17 p Presented at the Workshop on High Brightness, High Current, High Duty Factor Ion Injectors, San Diego, Calif., 21 May 1985
(Contract W-7405-eng-36)
(DE85-015689; LA-UR-85-1627; CONF-8505164-3) Avail: NTIS HC A02/MF A01

We describe a proposed method to funnel ion beams using a new form of the radio-frequency quadrupole (RFQ) structure. This RFQ accepts two bunched ion beams and combines them into a single final beam with interlaced microstructure pulses. It also provides uninterrupted periodic transverse focusing to facilitate the funneling of beams with high current and low emittance. DOE

N86-14017# Stanford Linear Accelerator Center, Calif.
LINEAR ACCELERATORS FOR TeV COLLIDERS
P. B. Wilson May 1985 20 p Presented at the 2nd Intern. Workshop on Laser Acceleration of Particles, Los Angeles, 7 Jan. 1985
(Contract DE-AC03-76SF-00515)
(DE85-014958; SU-SLAC-PUB-3674; CONF-850128-17) Avail: NTIS HC A02/MF A01

This paper summarizes four tutorial lectures on linear electron accelerators: Electron Linacs for TeV Colliders, Emittance and Damping Rings, Wake Fields: Basic Concepts, and Wake Field Effects in Linacs. DOE

N86-14018# Los Alamos National Lab., N. Mex.
REACTIVE SCATTERING IN THE BENDING-CORRECTED ROTATING LINEAR MODEL
R. B. Walker and E. F. Hayes 1985 30 p refs Presented at the NATO Workshop on Chem. Reactions in Organic Constrained Systems, Orleans, France, 23 Jun. 1985 Prepared in cooperation with National Science Foundation, Washington, D.C.
(Contract W-7405-eng-36)
(DE85-017539; LA-UR-85-2994; CONF-8506109-2) Avail: NTIS HC A03/MF A01

We review the theory and applications of the Bending-Corrected Rotating Linear Model (BCRLM) to problems in the quantum description of reactions between atoms and diatomic molecules. DOE

N86-14019# Los Alamos National Lab., N. Mex.
COLLECTIVE ION ACCELERATION BY MEANS OF VIRTUAL CATHODES
W. Peter, R. J. Faehl, C. Snell, and M. E. Jones 1985 14 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-36)
(DE85-012707; LA-UR-85-1653; CONF-850504-89) Avail: NTIS HC A02/MF A01

Experiments on collective ion acceleration by means of the formation of a virtual cathode have been carried out for a number of years in the Soviet Union and in the United States. Recently, there has been renewed interest in the subject as a possible means of accelerating ions to very high energies. By understanding the physics underlying the acceleration process it may be possible to determine the feasibility of virtual cathode staging for very high energy ion production. For this reason, a theoretical and computational effort is underway at Los Alamos in order to clarify the basic issues of collective ion acceleration by means of virtual cathodes. To support the theoretical effort, simulations were done with the fully electromagnetic and relativistic particle-in-cell code ISIS (in a one-dimensional mode) and the electrostatic one-dimensional code BIGONE. In the simulations, an electron beam of density 6 x 10 to the 11/cc is injected into a one-dimensional box of lenght L. To supply the necessary ions for collective acceleration, a plasma source containing both ions and electrons was initialized near the emitting boundary. Of prime interest in this study was to understand the dynamics of virtual cathode formation and the dynamics of the acceleration process for the ions. In particular, the question of whether the ions are accelerated by a moving potential well or hydrodynamic pressure due to ambipolar expansion is of primary interest. DOE

N86-14020# Lawrence Livermore National Lab., Calif.
ASPECTS OF THREE FIELD APPROXIMATIONS: DARWIN, FROZEN, EMPULSE
25 May 1985 15 p
(Contract W-7405-eng-48)
(DE85-014204; UCID-20453) Avail: NTIS HC A02/MF A01

The traditional approach used to study high energy beam propagation relies on the frozen field approxiamtion. A minor modification of the frozen field approximation yields the set of equations applied to the analysis of the hose instability. These models are constrasted with the Darwin field approximation. A statement is made of the Darwin model equations relevant to the analysis of the hose instability. DOE

N86-14021# Los Alamos Scientific Lab., N. Mex.
POLARIZATION TRANSFER IN ENELASTIC SCATTERING AND PIONIC MODELS OF THE EMC EFFECT
T. A. Carey, K. W. Jones, J. B. McClelland, J. M. Moss, L. B. Rees, N. Tanaka, and A. D. Bacher 1985 3 p refs Presented at the Intern. Symp. on Polarization Phenomena in Nucl. Phys., Osaka, 26 Aug. 1985 Prepared in cooperation with Indiana Univ., Bloomington
(Contract W-7405-eng-36)
(DE85-014119; LA-UR-85-2047; CONF-850807-3) Avail: NTIS HC A02/MF A01

The aim of the experiment reported was to make a precise test of the enhanced pion field model in a medium-energy scattering experiment. the quantity probed is the spin-longitudinal response function, a measure of the nuclear pion density which is used explicitly in the pion-excess models of the EMC effect. The point of reference used is deuterium. The spin-dependent response functions for heavy targets and (2)H are compared using identical experimental techniques. The technique of complete polarization transfer is used to separate the spin-longitudinal and spin-transverse response in the continuum. The experiment consisted of precise determinations of the polarization transfer coefficients for 500 MeV protons inelastically scattered from Pb, Ca, and (2)H. The experiment utilized longitudinal, sideways, and normal polarized beams in conjunction with final polarization analysis from the focal-plane polarimeter of the high-resolution spectrometer. Quantities constructed from these data are the longitudinal and transverse spin-flip probabilities. Calculations were performed of the ratio of longitudinal to transverse response functions and of the EMC effect with the same model. No evidence was found for collectivity in the isovector spin-longitudinal response function. DOE

N86-14084*# Alabama State Univ., Montgomery.
DETERMINATION OF NEUTRON FLUX DISTRIBUTION BY USING ANISN, A ONE-DIMENSIONAL DISCRETE S SUB n ORDINATES TRANSPORT CODE WITH ANISOTROPIC SCATTERING Final Report

Susanta K. Ghorai *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 18 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20H

N86-14100*# Abilene Christian Coll., Tex.
ION BOMBARDMENT AND ADSORPTION STUDIES ON ILMENITE (FeTiO3) BY X-RAY PHOTOELECTRON SPECTROSCOPY Final Report
Paul D. Schulze *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Research Program Research Reports Sep. 1983 10 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 08H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-14022# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
COUPLED RADIATION TRANSPORT/THERMAL ANALYSIS OF THE RADIATION SHIELD FOR A SPACE NUCLEAR REACTOR Ph.D. Thesis
W. J. Barattino Jul. 1985 362 p
(AD-A158180; AFIT/CI/NR-85-53D) Avail: NTIS HC A16/MF A01 CSCL 18/6

A coupled radiation transport-heat transfer-stress analysis of the radiation shield for an SP-100 reactor was performed using a numerical code developed at the University of New Mexico and Sandia National Laboratory. For a fast reactor operating at 1.66 MW sub th, the energy deposited and resulting temperature distribution was determined for a shield consisting of tungsten and lithium hydride pressed into a stainless steel honeycomb matrix. While temperature feedback was shown to have a minor effect on energy deposition, the shielding configuration was found to have a major influence in meeting thermal requirements of the lithium hydride. It was shown that a shield optimized for radiation protection will fail because of melting. However, with minor modifications in the shield layering and material selection, the thermal integrity of the shield can be preserved. A shield design of graphite, depleted lithium hydride, tungsten, and natural lithium hydride was shown to satisfy neutron and gamma fluence requirements, maximum temperature limits, and minimize cracking in the LiH portion of the shield. GRA

N86-14023# California Univ., Berkeley. Lawrence Berkeley Lab.
NEW CONTROL TECHNIQUES FOR EXTRACTION OF BEVALAC BEAMS
M. Nyman, W. Chu, B. Mehlman, W. Mirer, H. Oakley, T. Renner, G. Stover, and M. Tekawa May 1985 5 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13-16 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-017640; LBL-18946; CONF-850504-274) Avail: NTIS HC A02/MF A01

Beams of accelerated heavy ions can now be delivered as one second long dc pulses with minimal fluctuations in instantaneous flux. Pulse duration can be held constant to within 1% while keeping a high nonvarying extraction efficiency which minimizes pulse to pulse position shift in the extracted beam. In addition, differing beam intensities over several orders of magnitude can be delivered. Computer adjustment of all measurement and control devices results in linear operation over three orders of magnitude of beam intensity. Control of beam structure is accomplished by a unique combination of dual slope integrators and phase forward predictive circuits in the feedback loop. DOE

N86-14024# Rockwell International Corp., Golden, Colo.
HIGH COUNT RATE GAMMA-RAY SPECTROMETER SYSTEM FOR PLUTONIUM ISOTOPIC MEASUREMENTS
J. G. Fleissner, C. P. Oertel, and A. G. Garrett 1985 20 p Presented at the 26th Ann. Meeting of the Inst. of Nucl. Mater. Management, Abluquerque, N. Mex., 21 Jul. 1985
(Contract DE-AC04-76DP-03533)
(DE85-013212; RFP-3792; CONF-850765-29) Avail: NTIS HC A02/MF A01

The High Count Rate Gamma Ray Spectrometer (HCRS) for plutonium isotopic measurement produces many benefits for both production and safeguards applications. It shortens the count times to approximately ten minutes. Its production rate is about 400% greater. It is easy to use. It requires reduced human exposure, and there is more timely reporting of results. In addition, it is comprised of off the shelf commercial components. F.M.R.

N86-14025# Fermi National Accelerator Lab., Batavia, Ill.
OPERATION OF LARGE CRYOGENIC SYSTEMS
C. H. Rode, B. Ferry, W. B. Fowler, J. Makara, T. Peterson, J. Theilacker, and R. Walker Jun. 1985 6 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-03000)
(DE85-017439; FNAL-TM-1314; CONF-850504-267) Avail: NTIS HC A02/MF A01

This report is based on the past 12 years of experiments on R and D and operation of the 27 kW Fermilab Tevatron Cryogenic System. In general the comments are applicable for all helium plants larger than 1000W (400 1/hr) and non mass-produced nitrogen plants larger than 50 tons per day. DOE

N86-14026# Oak Ridge National Lab., Tenn.
THE (58)Ni + n TRANSMISSION, CAPTURE AND DIFFERENTIAL ELASTIC SCATTERING DATA ANALYSIS IN THE RESONANCE REGION
C. M. Perey, F. G. Perey, J. A. Harvey, N. W. Hill, and R. L. Macklin 1985 5 p Presented at the Intern. Conf. on Nucl. Data for Basic and Appl. Sci., SantaFe, N. Mex., 13 May 1985
(Contract DE-AC05-84OR-21400)
(DE85-016157; CONF-850507-52) Avail: NTIS HC A02/MF A01

High-resolution neutron transmission, capture and differential elastic scattering measurements have been made for (58)Ni-enriched targets at the Oak Ridge Electron Linear Accelerator (ORELA) from the eV to the MeV region. The three sets of data were analyzed simultaneously from 10 to 450 keV, and the transmission analysis was extended to 650 keV. For the 52 s-wave resonances observed between 10 and 650 keV, the average level spacing, D0, and the strength function, s0, are 12.2 + - 1.0 keV and (3.1 + - 0.6) x 10(-4), respectively. DOE

N86-14027# Oak Ridge National Lab., Tenn.
STRUCTURE AND HYDRODYNAMICS OF COLLOIDAL SYSTEMS
J. B. Hayter Jul. 1985 17 p Presented at the Intern. Conf. on Neutron Scattering, Santa Fe, N. Mex., 19 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-016294; CONF-850871-6) Avail: NTIS HC A02/MF A01

Colloidal phases (for example, micellar solutions, latex suspensions, ferrofluids and microemulsions) provide excellent model systems with which to test structural and hydrodynamic theories of the liquid state. Interparticle potentials may be attractive or repulsive, and the experimentalist is often free to control the strength, range and symmetry of the interactions. Small-angle neutron scattering (SANS) and small-angle neutron spin-echo (SANSE) provide excellent complementary tools for studying the structure and time-dependence of these systems, where correlation lengths typically vary from about one to several tens of nm. Correlation times are usually in the nsec to (MU) sec range, but may be of order minutes in certain systems. This paper will review some of the current theories and their recent experimental tests, using colloidal systems in which the direct interaction potentials

may have spherical, dipolar or cylindrical symmetry and the hydrodynamic interactions may be weak or strong. DOE

N86-14028# Fermi National Accelerator Lab., Batavia, Ill.
VARIABLE CURVATURE PHANTOM
I. Rosenberg, M. Awschalom, and R. K. TenHaken Apr. 1985 4 p
(Contract DE-AC02-76CH-03000)
(DE85-014260; FNAL-TM-1310) Avail: NTIS HC A02/MF A01

The design of a variable curvature dosimetry phantom is briefly described. The phantom was developed to test the accuracy of the dose modification algorithms used to estimate dose distributions inside patient contours. DOE

N86-14029# Stanford Linear Accelerator Center, Calif.
HARDWARE UPGRADE FOR KLYSTRONS IN THE SLC
R. K. Jobe, M. J. Browne, and K. P. Slattery May 1985 3 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-014357; SU-SLAC-PUB-3666; CONF-850504-184) Avail: NTIS HC A02/MF A01

The control and monitoring of the klystrons in the first third of the SLAC linear accelerator has been commissioned, and a program to complete installation by summer 1985 is in progress. A general overview of the new control system for SLAC klystrons is presented along with a detailed description of the Modulator Klystron Support Unit. The MKSU contains all the devices necessary to interface klystron monitoring and control to the SLC control system through a dedicated intelligent CAMAC module. Controlled devices include RF phase and drive controls, the high power modulator status, associated RF signals, waterflow and magnet controls. DOE

N86-14030# Mound Lab., Miamisburg, Ohio.
MOUND ACTIVITIES IN CHEMICAL AND PHYSICAL RESEARCH: JULY DECEMBER 1984
17 Jun. 1985 27 p refs
(Contract DE-AC04-76DP-00053)
(DE85-014402; MIM-3258) Avail: NTIS HC A03/MF A01

Progress reports are presented in the following areas: (1) low-temperature research (deuterium triple point temperature standard, helium second virial as applied to gas thermometry); and (2) separation research (liquid phase thermal diffusion, calcium isotope separation, low temperature trenschaukel, calcium chemical exchange). DOE

N86-14031# GA Technologies, Inc., San Diego, Calif.
DOUBLET 3 Annual Report, 1 Oct. 1983 - 30 Sep. 1984
May 1985 116 p
(Contract DE-AC03-84ER-51044)
(DE85-014369; GA-A-18024) Avail: NTIS HC A06/MF A01

The operating space accessible to Doublet III, together with maximum values of some of the plasma parameters which were achieved during the course of energy confinement and high beta experiments are investigated. For those parameters correlated with good energy confinement, such as elected and ion temperatures, stored energy, and neutron rate, the maximum values were obtained in high current, high toroidal field, divertor discharged with deuterium beam heating. Doublet III was the first tokamak to produce beta values of factor interest. High toriodal beta and low q values were obtained in lower toroidal field, limiter discharges. The most recent experiments were performed with up to 8 MW of neutral beam heating power and up to 1 MW of 60 GHz ECH power. Operations and maintenance are detailed, as is progress in vessel modification MOF, electron cylotron heating MOF, and the Doublet III US/Japan cooperation upgrade. E.R.

N86-14032# Los Alamos Scientific Lab., N. Mex.
LOW POWER REACTOR FOR REMOTE APPLICATIONS
K. L. Meier, R. G. Palmer, and W. L. Kirchner 1985 7 p refs Presented at the 20th Intersoc. Energy Conversion Eng. Conf., Miami Beach, Fla., 18 Aug. 1985
(Contract W-7405-eng-36)
(DE85-012763; LA-UR-85-1870; CONF-850808-6) Avail: NTIS HC A02/MF A01

A compact, low power reactor is being designed to provide electric power for remote, unattended applications. Because of the high fuel and maintenance costs for conventional power sources such as diesel generators, a reactor power supply appears especially attractive for remote and inaccessible locations. Operating at a thermal power level of 135 kWt, the power supply achieves a gross electrical output of 25 kWe from an organic Rankine cycle (ORC) engine. By intentional selection of design features stressing inherent safety, operation in an unattended mode is possible with minimal risk to the environment. Reliability is achieved through the use of components representing existing, proven technology. Low enrichment uranium particle fuel, in graphite core blocks, cooled by heat pipes coupled to an ORC converter insures long term, virtually maintenance free, operation of this reactor for remote applications. DOE

N86-13565# Rensselaer Polytechnic Inst., Troy, N.Y.
VARIABLE FIELD EFFECTS FOR THE ROTATING FLUIDIZED BED REACTOR Abstract Only
Owen C. Jones *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13604# Joint Publications Research Service, Arlington, Va.
NATION'S ACHIEVEMENTS IN HIGH ENERGY PHYSICS REVIEWED
Zhang Wenyu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 76-89 Transl. into ENGLISH from Gaoneng Wuli (Beijing), no. 3, Sep. 1984 p 1-6 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

74 OPTICS

Includes light phenomena.

N86-14033*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TEST METHOD FOR TELESCOPES USING A POINT SOURCE AT A FINITE DISTANCE Center Director's Discretionary Fund Final Report
Donald B. Griner, David E. Zissa, and Dietrich Korsch (Korsch Optics, Inc.) Sep. 1985 23 p refs
(Proj. H20)
(NASA-TM-86523; NAS 1.15:86523) Avail: NTIS HC A02/MF A01 CSCL 20F

A test method for telescopes that makes use of a focused ring formed by an annular aperture when using a point source at a finite distance is evaluated theoretically and experimentally. The results show that the concept can be applied to near-normal, as well as grazing incidence. It is particularly suited for X-ray telescopes because of their intrinsically narrow annular apertures, and because of the largely reduced diffraction effects. Author

N86-14034# Army Missile Command, Redstone Arsenal, Ala.
REAL TIME LARGE MEMORY OPTICAL PATTERN RECOGNITION
D. A. Gregory Jun. 1984 124 p
(AD-A158023; AD-E950731; AMSMI/RR-84-9-TR) Avail: NTIS HC A06/MF A01 CSCL 14/5

A large memory optical recognition system has been developed and tested. The memory consists of an array of stored holographic Fourier transform matched filters in a VanderLugt type correlator. The filters are stored (on high resolution Kodak plates) and addressed using a novel holographic multi-focus lens. This element acts as a diffraction grating, splitting the input beam into 25 elements and as a lens, producing the Fourier transform of each of the 25 elements. The filters are created and addressed

using a HeNe laser and a Hughes liquid crystal light valve (LCLV) to produce a coherent image from a television monitor. The LCLV also allows the filters to be addressed in real time thereby making the use of a transparency as an input scene unnecessary. This provides for real time recognition. Thus far, more than 70 matched filters have been stored on a single holographic plate and addressed in parallel and in real time with good correlations resulting. This research and the results obtained should contribute to allowing serious consideration to be given to the use of optical recognition systems for a wide variety of civilian and military applications. Author (GRA)

N86-14035# Naval Postgraduate School, Monterey, Calif.
HIERARCHICAL IMAGE TO SEGMENTATION TO INFRARED IMAGES M.S. Thesis
J. D. Bloomquist Jun. 1985 71 p
(AD-A158030) Avail: NTIS HC A04/MF A01 CSCL 17/5

Recursive image segmentation with hierarchical scope views is a new technique in image processing which systematically divides an image into smaller and smaller quadrants with each region within the quadrants having a structured descriptor. The regions are then processed to remove noise and to check for connected regions across the quadrant boundaries. The quadrants are then brought back together with the obsecured target enhanced and distinguishable from the background. Infrared image data of five different ship targets with the associated noise and interference was processed by this technique with the target information being greatly enhanced. The procedures developed to evaluate the data were found to be inadequate for the task, neccessitating hand evaluation to extract the target. The technique was proven to be a viable solution for extracting target information from infrared data, but very slow processing times and inadequate evaluation procedures limit the usefulness of the program in its present form. GRA

N86-14036# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
MULTIGRID RELAXATION METHODS AND THE ANALYSIS OF LIGHTNESS, SHADING, AND FLOW
D. Terzopoulos Oct. 1984 25 p
(Contract N00014-80-C-0505)
(AD-A158173; AI-M-803) Avail: NTIS HC A02/MF A01 CSCL 20/6

Image analysis problems, posed mathematically as variational principles or as partial differential equations, are amenable to numerical solution by relaxation algorithms that are local, iterative, and often parallel. Although they are well suited structurally for implementation on massively parallel, locally-interconnected computational architectures, such distributed algorithms are seriously handicapped by an inherent inefficiency at propagating constraints between widely separated processing elements. Hence, they converge slowly when confronted by the large representations necessary for low-level vision. Application of multigrid methods can overcome this drawback, as we established in previous work on 3-D surface reconstruction. In this paper, we develop efficient multiresolution iterative algorithms fo computing lightness, shape-from-shading, and optical flow, and we evaluate the performance of these algorithms on synthetic images. This multigrid methodology is broadly applicable in low-level vision. Notably, it is an appealing strategy to use in conjunction with regularization analysis for the efficient solution of a wide range of ill-posed visual reconstruction problems. GRA

N86-14037# Mississippi State Univ., Mississippi State.
RESULTS OF RESEARCH IN FOUR TOPIC AREAS: THE SINGULARITY EXPANSION METHOD, TRANSIENT SCATTERING MEASUREMENTS, HIGH-FREQUENCY DIFFRACTION AT EDGES RESIDING ON INTERFACES AND CYLINDRICAL COORDINATE REPRESENTATION OF DYADIC GREEN'S FUNCTIONS Final Report, 1 Jan. 1981 - 1 Aug. 1985
L. W. Pearson and A. W. Glisson, Jr. 1 Aug. 1985 7 p
(Contract N00014-81-K-0256)
(AD-A158382) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report briefly presents the results of research in four topic areas investigated during the grant period. These four topic areas are; the Singularity Expansion Method, transient scattering measurements, high frequency diffraction at edges residing on interfaces, and cylindrical coordinate representation of dyadic Green's functions. GRA

N86-14038# Missouri Univ., Kansas City.
OPTICAL CONSTANTS Contractor Report, Sep. 1982 - May 1984
M. R. Querry Jun. 1985 415 p
(Contract DAAK11-82-C-0069)
(AD-A158623; CRDC-CR-85034) Avail: NTIS HC A18/MF A01 CSCL 20/6

Reflectance spectra of 23 materials were acquired at near normal incidence in the ultraviolet, visible and infrared spectral regions. The optical constants of the materials were determined by use of Kramers-Kronig methods. The 23 materials were: (1) Sapphire (Al2O3)E//C, (2) Sapphire (Al2O3)E+C, Oxidized aluminum mirror, (4) Iron, (5) Hematite (Fe2O3)E//C, (6) Hematite (Fe2O3)E+C, (7) Magnetite (Fe3O4), (8) Cuprous oxide (Cu2O) pellet, (9) Zinc oxide (Zno) pellet, (10) Copper Ingot, (11) Brass Ingot (90 Cu/10 Zn), (12) Brass Ingot (85 Cu/15 Zn), (13) Brass Ingot(70 Cu/30 Zn), (14) Dixon KS-2 Graphite pellet, (15) Dixon HPN-2 Graphite pellet, (16) Dixon 200-10 Graphite pellet, (17) Asbury Micro 260 Graphite pellet, (18) Dixon 1102 Intercalated Graphite pellet, (19) Asbury 3222 Intercalated Graphite pellet, (20) Pyrolytic Graphite (on planar face), (21) Pyrolytic Graphite (on planar face), (21) TTF/TCNQ pellet, (22) Cu/TCNQ pellet, and Li/TCNQ pellet. Final data were supplied on punched cards, and in graphical and tabular. GRA

N86-14039# Washington State Univ., Pullman. Dept. of Physics.
LIGHT SCATTERING FROM BUBBLES IN LIQUIDS
D. S. Langley Dec. 1984 131 p
(Contract N00014-80-C-0838)
(AD-A158736; TR-4) Avail: NTIS HC A07/MF A01 CSCL 20/6

The scattering of laser light from bubbles in liquids was photographed, and angular features in the far-zone intensity are compared with models. Diffraction effects are prominent in three regions of the scattering: near the critical angle, and in the forward and backward directions. The forward and backward scattered light exhibits the intensity enhancement known as the glory. Simple geometrical optics is unable to approximate the scattering pattern in the diffraction regions. Physical-optics models are presented for each case and shown to be in agreement with the observations. These models give insight into the optical properties of scatterers whose refractive index is less than that of their surroundings. Comparisons also include the results of Mie theory computations for the critical-angle and forward regions. Some applications of the results to the sizing and detection of bubbles are discussed. GRA

N86-14040# Defence Research Establishment Valcartier (Quebec).
INVESTIGATION OF COLD COLORED SMOKE PRODUCTION
T. Liberman Aug. 1985 43 p
(AD-A158783; DREV-R-4372/85) Avail: NTIS HC A03/MF A01 CSCL 19/1

The main objective of this project is to develop a nonfading colored cold smoke composition for use in a signal cartridge for practice bombs. The primary constraint is that the substance must not require any form of heat to produce the smoke; hence the term cold smoke. The principal use of the colored cold smoke charge is to mark the point of impact of practice bombs used by the Canadian Forces (CF). In summertime, white smoke produced by titanium tetrachloride (TiCl4) is satisfactory; however, colored smoke is required during winter because of the white snow background. Different methods for producing large colored smoke clouds for use as spotting charges are evaluated. The problem of the disappearance, or bleaching, of the orange color from vanadium oxytrichloride (VOCl3) clouds during times of high

relative humidity is considered. It is postulated that this is caused by the absorption of large quantities of atmospheric moisture by the smoke. A model has been developed to study the process. This model makes the key predictions concerning the absorption of very large amounts of atmospheric moisture by VOCl3 type smokes above a relative humidity of 80% and the very small importance of temperature as a parameter. These predictions are, in general, corroborated very well by experiment. Possible solutions to this color bleaching problem are discussed, including one that calls for the synthesis of hydrolyzable vanadium compounds with nonhygroscopic leaving groups. GRA

N86-14041# Department of the Navy, Washington, D. C.
AN INTEGRATED WAVELENGTH DEMULTIPLEXER Patent Application
R. E. Reedy, inventor (to Navy) Filed 1 Jul. 1985 28 p
(AD-D011867; US-Patent-Appl-SN-750630) Avail: NTIS HC A03/MF A01 CSCL 20/6

An optical wavelength demultiplexer is fabricated as an integral part of an integrated circuit chip. A waveguide in a common substrate having a chirped diffraction grating receives a number of wavelengths of optically modulated data from a single mode fiber. The wavelengths are diffracted from the plane of the lines of the grating into discrete beams at discrete angles through the substrate and impinge on appropriately located photodetectors. Signals provided by the detectors are fed to an processed by other integrated circuitry also contained on the chip. The common transparent substrate such as fused silica, glass, sapphire, lithium niobate or lithium tantalate mount semiconductor films of Si, Ge GaAs or quaternary alloys that have the detectors and other integrated circuitry that are created by conventional CVD techniques. The waveguide and appropriate chirp grating are formed by established deposition and photolithographic procedures to assure the separation of as many as fifty discrete beams of as many different wavelengths and their projection onto a like number of photodetectors to provide for a heretofore unattainable degree of optical wavelength demultiplexing. Author (GRA)

N86-14042# Department of the Army, Washington, D. C.
OPTICAL RADAR TRANSCEIVER CONTROL APPARATUS Patent Application
R. J. Mongeon, R. J. Wayne, and R. W. Henschke, inventors (to Army) Filed 1 Aug. 1985 21 p
(AD-D011880; US-Patent-Appl-SN-761257) Avail: NTIS HC A02/MF A01 CSCL 17/9

The apparatus is part of an optical radar set and comprises a high powered CO2 pulsed transmitter laser which is injection controlled to operate at a fixed frequency offset from a lower powered CO2 local oscillator laser. A portion of the output of the local oscillator laser is applied to an acousto-optic Bragg cell, together with an RF signal equal to the desired intermediate frequency of the radar set. The upshifted first order output of the Bragg cell is injected into the transmitter laser for stabilization purposes. This results in a stable intermediate frequency for the optical radar set. Author (GRA)

N86-14043# Department of the Navy, Washington, D. C.
OPTOELECTRONIC INTEGRATED CIRCUIT MULTIPLIER Patent Application
R. E. Reedy, J. H. Harris, and D. J. Albares, inventors (to Navy) Filed 20 Jun. 1985 26 p
(AD-D011883; US-Patent-Appl-SN-746704) Avail: NTIS HC A03/MF A01 CSCL 20/6

An apparatus and method for improving VLSI and VHSIC system data transmission relies on a plurality of optoelectronic switches actuated by pulses from at least one light source, a laser. Differing lengths of optical fibers couple the pulsed light from the laser at different times to create a sequence of actuation light pulses for the plurality of optoelectronic switches each time the light source is pulsed. Thus, the information appearing at a plurality of parallel data nodes is converted to serial form at an output bonding pad on the chip. Optionally, a similar pulsing of electroptic switches coupled to an input bonding pad converts serial data to parallel form. Faster input and output switching times are provided, reliability and complexity are reduced, particularly as compared to off-chip arrangements, and power consumption and dissipation are reduced. Author (GRA)

N86-14044# Department of the Navy, Washington, D. C.
FIBER OPTICS AS AN ANGULAR SENSOR Patent Application
H. Rieger, inventor (to Navy) Filed 27 Jun. 1985 12 p
(AD-D011886; US-Patent-Appl-SN-749340) Avail: NTIS HC A02/MF A01 CSCL 17/8

This patent application discloses an uncomplicated, compact and environmentally-immune sensor for the degree of articulation of finger joints in a remote underwater vehicle which uses a length of an optical fiber connected to each finger joint. As the joint is rotated, the bending of the optical fiber changes the attenuation of light through the fibers and a detector monitoring this change provides a signal that is correlated to the degree of articulation. GRA

N86-13564# Spectron Development Labs., Inc., Costa Mesa, Calif.
OPTICAL TECHNIQUE TO MEASURE ELECTRODE EROSION Abstract Only
James D. Trolinger and David F. Schaack *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13569# SRI International Corp., Menlo Park, Calif. Chemical Physics Lab.
TWO-PROTON DETECTION TECHNIQUES FOR ATOMIC FLUORINE Abstract Only
William K. Bischel *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13570# California Univ., Berkeley. Dept. of Mechanical Engineering.
COHERENT OPTICAL TRANSIENT SPECTROSCOPY IN FLAMES Abstract Only
John W. Daily *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13573# Stanford Univ., Calif.
OPTICAL PROCESSING AND PHASE CONJUGATION Abstract Only
Lambertus Hesselink *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13605# Joint Publications Research Service, Arlington, Va.
INTEGRATED OPTICS DEVELOPMENTS OVER PAST DECADE, FUTURE PROSPECTS
Yu Rongjin *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 90-95 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 4, 20 Apr. 1985 p 193-196 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-13779# Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF BRIGHTNESS FROM POINT SOURCE OF SCATTERED LIGHT ALONG INCLINED PATH Abstract Only
A. S. Drofa and A. L. Usachev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 28 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 6, Jun. 1985 p 603-608 Original language document was announced in IAA as A85-44481 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13781# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF FOG MICROSTRUCTURE ON QUALITY OF OPTICAL IMAGE TRANSMITTED THROUGH IT Abstract Only
L. P. Volnistova, A. S. Drofa, and V. P. Snykov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 29-30 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 21, no. 6, Jun. 1985 p 507-511 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13786# Joint Publications Research Service, Arlington, Va.
STATISTICS OF INTENSIVE LIGHT BEAMS IN TURBULENT ATMOSPHERE Abstract Only
V. P. Kandidov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 34 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 442-449 Original language document was announced in IAA as A85-31855 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13791# Joint Publications Research Service, Arlington, Va.
EFFECTIVENESS OF USE OF ADAPTIVE OPTICAL SYSTEMS UNDER CONDITIONS OF SELF-EFFECT IN ATMOSPHERE Abstract Only
P. A. Konyayev, V. P. Lukin, and V. L. Mironov *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 38 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Ser. Fiz. (Moscow), v. 49, no. 3, Mar. 1985 p 536-540 Original language document was announced in IAA as A85-31867 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14089*# Middlesex County Coll., N.J. Dept. of Mech./Civil Technology.
SPECTRAL REFLECTANCE OF SURFACE SOILS: RELATIONSHIPS WITH SOME SOIL PROPERTIES Final Report
Carl H. Kiesewetter *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 27 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-14045# Hiroshima Univ. (Japan).
POPULATION INVERSION IN A RECOMBINING HYDROGEN PLASMA INTERACTING WITH A HELIUM GAS
Toshiatsu Oda (Hiroshima Univ.) and Utaro Furukane (Ehime Univ., Japan) Nagoya, Japan Nagoya Univ. Aug. 1984 17 p refs
(IPPJ-692) Avail: NTIS HC A02/MF A01

A numerical investigation has shown that the population inverstion between the levels with the principal quantum number i=2 and 3 takes place in a recombining hydrogen plasma which is interacting with a cool and dense helium gas on the basis of a collision-radiative (CR) model. Overpopulation density, which is defined as the difference between the population densities per unit statistical weight of the upper and lower excited levels 3 and 2, is found to be much higher than a threshold level for the laser oscillation in the quasi-steady state when the hydrogen plasma interacts with the helium gas with pressure of approx. 50 Torr.
Author

N86-14046# Kyoto Univ. (Japan). Dept. of Electronics.
HIGH ORDER SPLINE INTERPOLATION IN THE PARTICLE SIMULATION
Hirotada Abe, Natsuhiko Sakairi, Ryohei Itatani, and Hideo Okuda (Princeton Univ.) Nagoya, Japan Nagoya Univ. Jun. 1985 37 p refs
Avail: NTIS HC A03/MF A01

In the conventional plasma simulation models using particles, in which the total momentum is conserved, the total energy is not conserved due to nonuniformity of space caused by the spatial grids. The grid spacing was severely limited of order of the Debye length. It is found that the use of the high order spline spatial interpolation removes this limit without a significant increase of the computation and complexity of the algorithm in the system that only the long-wavelength, collective phenomena are important. The theoretical analysis of the total energy is improved compared with the previous work and its scaling law is related to so-called the aliasing error explicitly. The coefficient eta introduced previously is referred as the model index and is used again as a measure of the accuracy of the models for the energy conservation.
Author

N86-14047# Yamanashi Univ., Kofu (Japan). Faculty of Engineering.
PARAMETRIC EXCITATION OF ION BERNSTEIN WAVES BY MAGNETOSONIC WAVE
M. Matsumoto, K. Sakai, and S. Takeuchi Nagoya, Japan Nagoya Univ. Jul. 1985 16 p refs
(IPPJ-738) Avail: NTIS HC A02/MF A01

In a uniformly magnetized plasma ion Bernstein waves are parametrically excited by a magnetosonic (pump) wave which propagates perpendicularly to the static magnetic field B sub 0. The pump wave is assumed with K sub 0 not equal to 0 and omega sub 0 approx. equals 2 OMEGA sub 0, OMEGA sub 0 being the ion cyclotron frequency. The growth rate of the excited wave which also propagates perpendicularly to B sub 0 is obtained in the first order of magnitude K sub 0. the analysis is based on a method of intergration along the dynamical trajectory of particle in the static and electromagnetic pump fields.
Author

N86-14048# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRELIMINARY EXPERIMENT ON ELECTRON BEAM INJECTION FOR TOKAMAK CURRENT DRIVE
A. Mohri, S. Kubo, M. Hasegawa, K. Narihara, H. Tanaka (Kyoto Univ.), A. Ando (Kyoto Univ.), K. Ogura (Kyoto Univ.), T. Makewa (Kyoto Univ.), Y. Terumichi (Kyoto Univ.), and S. Tanaka (Kyoto Univ.) Jul. 1985 14 p refs
(IPPJ-739) Avail: NTIS HC A02/MF A01

Electron beams with moderate energies, 0.4 to 2 keV, were injected for 5 ms into a small tokamak WT-2 by using the plasma anode method. The injection into a currentless plasma of a density 2.5 x 10 to the 18th power m(-3) at a toroidal field 1.1 T formed a toroidal current 4 kA, which was nine times the injected beam current. Also, an inductively produced toroidal current was sustained during the injection.
Author

N86-14049# Yamanashi Univ., Kofu (Japan). Inst. of Plasma Physics.
UNLIMITED ACCELERATION OF CHARGED PARTICLES BY AN ELECTROMAGNETIC WAVE WITH A PURELY TRANSVERSE ELECTRIC FIELD PROPAGATING PERPENDICULARLY TO A STATIC MAGNETIC FIELD
S. Takeuchi (Yamanashi Univ.), K. Sakai (Yamanashi Univ.), M. Matsumoto (Yamanashi Univ.), and R. Sugihara Jul. 1984 20 p refs
(IPPJ-740) Avail: NTIS HC A02/MF A01

It is found that a charged particle can be trapped by a magnetic neutral sheet which is produced by a static magnetic field B sub 0 and a magnetic field of an electromagnetic wave propagating perpendicularly to B sub 0. Once the particle is trapped, it never detraps and moves with the neutral sheet with the phase velocity. The trapped particle feels a constant force along the sheet and thus gains energy continuously from the wave. A brief discussion is given on how to realize such a slow wave which can interact with the particle.
Author

N86-14050# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PHYSICAL MECHANISMS FOR HOT ELECTRON STABILIZATION OF LOW FREQUENCY INTERCHANGE MODES

Heiji Sanuki and Francis F. Chen (California Univ., Los Angeles) Aug. 1985 24 p refs
(IPPJ-741) Avail: NTIS HC A02/MF A01

The stabilization of low frequency background and hot electron interchange modes is studied by using a relatively simple multi-fluid model. Physical pictures for the stabilization mechanisms such as the charge uncovering effect are given and compared with the stabilization of interchange modes by the finite Larmor radius (FLR) effect. Author

N86-14051# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EFFECTS OF NEUTRALS ON INTERNAL FORCES AND THERMAL CONDUCTION OF A PLASMA IN A MAGNETIC FIELD
K. Hirano Aug. 1984 21 p refs
(IPPJ-691) Avail: NTIS HC A02/MF A01

Using the Chapman-Enskog approximation the Boltzmann equation was solved to obtain friction and thermal forces appearing between ions and their parent atoms remaining in a plasma. The heat fluxes due to thermal conduction through ions and atoms were also evaluated. Charge transfer and the elastic scattering assuming the Sutherland potential were adopted as the basic collision process between ions and atoms. It was demonstrated that thermal force on neutrals always pushes them toward higher temperature region across a strong magnetic field but colder place along the field lines if the temperature is higher than 25 eV. A very small amount of neutrals, e.g., 1 ppm to the ion density, is found to be enough for neutrals transfering even much larger heat flux than the one by ion thermal conduction loss at a fusion temperature. Author

N86-14052# GT-Devices, Alexandria, Va.
NUMERICAL MODELS FOR PLASMA-SOLID INTERACTIONS IN ELECTROTHERMAL MASS ACCELERATORS Final Report, 22 Jun. 1982 - 21 Jun. 1985
N. K. Winsor, D. A. Tidman, and S. A. Goldstein Jun. 1985 50 p
(Contract DAAG29-82-C-0013)
(AD-A158637; ARO-19060.2-EG-S) Avail: NTIS HC A03/MF A01 CSCL 20/7

This report describes the physics contents of codes and the results applying them to simulations of electrothermal mass accelerators. The overall objective was to investigate the dynamics of these accelerators including 2D effects. This has involved the development of computer models for the interactions of multi-species plasma with solid surfaces in single and multiple module plasma mass accelerators. The models are being used to make choices between materials and discharge cavity designs most suitable for achieving long lifetime and high rep-rate performance for these accelerators. GRA

N86-14053# Oak Ridge National Lab., Tenn.
THEORY OF RESISTIVITY-GRADIENT-DRIVEN TURBULENCE
L. Garcia, P. H. Diamond, B. A. Carreras, and J. D. Callen Jul. 1985 63 p
(Contract DE-AC05-84OR-21400)
(DE85-015068; ORNL/TM-9363) Avail: NTIS HC A04/MF A01

A theory of the nonlinear evolution and saturation of resistivity driven turbulence, which evolves from linear rippling instabilities, is presented. The nonlinear saturation mechanism is identified both analytically and numerically. Saturation occurs when the turbulent diffusion of the resistivity is large enough so that dissipation due to parallel electron thermal conduction balances the nonlinearly modified resistivity gradient driving term. The levels of potential, resistivity, and density fluctuations at saturation are calculated. A combination of computational modeling and analytic treatment is used in this investigation. DOE

N86-14054# Lawrence Livermore National Lab., Calif.
ELECTROMAGNETIC PARTICLE-IN-CELL PLASMA SIMULATION
A. B. Langdon 22 Apr. 1985 5 p refs Presented at Orbital Dyn. and Appl. To Accelerators Workshop, Berkeley, Calif., 7 Mar. 1985
(Contract W-7405-eng-48)
(DE85-031223; UCRL-92531; CONF-8503105-9) Avail: NTIS HC A02/MF A01

PIC simulation tracks particles through electromagnetic fields calculated self consistently from the charge and current densities of the particles themselves, external sources, and boundaries. Already used extensively in plasma physics, such simulations have become useful in the design of accelerators and their RF sources. DOE

N86-14055# Lawrence Livermore National Lab., Calif.
IMPLICIT PLASMA SIMULATION
A. B. Langdon 3 Mar. 1985 22 p Presented at the 2nd Intern. School for Space Simulation, Honolulu, 3 Feb. 1985
(Contract W-7405-eng-48)
(DE85-016088; UCRL-92259; CONF-850266-8) Avail: NTIS HC A02/MF A01

Implicit time integration methods have been used extensively in numerical modeling of slowly varying phenomena in systems that also support rapid variation. Examples include diffusion, hydrodynamics and reaction kinetics. This article discussed implementation of implicit time integration in plasma codes of the particle in cell family, and the benefits to be gained. DOE

N86-14056# National Electrostatic Corp., Middleton, Wis.
TESTS OF COMPRESSED GEOMETRY NEC ACCELERATION TUBES
J. E. Raatz, R. D. Rathmell, P. H. Stelson, and N. F. Ziegler 1985 12 p refs Presented at the 4th Intern. Conf. on Electrostatic Accelerator Technol. and Assoc. Boosters, Buenos Aires, 15 Apr. 1985 Prepared in cooperation with ORNL
(Contract DE-AC05-84OR-21400)
(DE85-016392; CONF-850470-9) Avail: NTIS HC A02/MF A01

Tests have been performed in the 3 MV Pelletron test machine at NEC on a compressed geometry tube which increases the insulating length of the tube by eliminating the heated electrode assemblies (approx. 2.5 cm thick) at the end of each tube section. Some insert electrodes are changed to provide some trapping of secondary ions. The geometry tested provided an 18% increase in live ceramic in the tube. The compressed geometry tube allowed a terminal voltage of 3.55 MV on the 3 MV column at normal gradients of 30.3 kv/tube gap. The tube was also conditioned to more than 4 MV and remained stable in voltage with few sparks and with low X-ray levels for days at about 4 MV. This same performance could be achieved with or without arc discharge cleaning. DOE

N86-14057# Lawrence Livermore National Lab., Calif.
SLAC DIVERTOR CHANNEL ENTRANCE THERMAL STRESS ANALYSIS
G. L. Johnson, W. Stein, S. C. Lu, and R. A. Riddle 10 Jul. 1985 69 p
(Contract W-7405-eng-48)
(DE85-017877; UCID-20498) Avail: NTIS HC A04/MF A01

X-ray beams emerging from the new SLAC electron-position storage ring (PEP) impinge on the entrance to tangential divertor channels causing highly localized heating in the channel structure. Analyses were completed to determine the temperatures and thermally-induced stresses due to this heating. These parts are cooled with water flowing axially over them at 30(0)C. The current design and operating conditions should result in the entrance to the new divertor channel operating at a peak temperatue of 123(0)C with a peak thermal stress at 91% of yield. Any micro-cracks that form due to thermally-induced stresses should not propagate to the coolant wall nor form a path for the coolant to leak into the storage ring vacuum. DOE

N86-14058# California Univ., Berkeley. Lawrence Berkeley Lab.
EFFECT OF FOCUSING FIELD NONLINEARITIES IN MBE-4 ON TRANSVERSE BEAM DYNAMICS
C. M. Celata, V. O. Brady, L. J. Laslett, L. Smith, and I. Haber May 1985 6 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)

(DE85-016561; LBL-19527; CONF-850504-255) Avail: NTIS HC A02/MF A01

A particle simulation code was used to study the effect on transverse beam dynamics of nonlinearities of the focusing field in a linear accelerator transporting a multiple beam array. Nonlinear field strengths for various multiple-beam design geometries were calculated by relaxation codes for use in the simulation calculation. Nonlinearities due to asymmetry of the electrode array with respect to a single beam were found to be negligible. Electrode end effect nonlinearities led to emittance growth for off-axis beams, though for the geometry of MBE-4, this was negligible. For misaligned beams, a dodecapole field caused significant emittance growth. This was not seen in single particle tracking calculations. Fields due to induced charge on the electrodes can reduce this effect, or the dodecapole field can be eliminated by proper choice of the electrode radius. DOE

N86-14059# Los Alamos National Lab., N. Mex.
DENSE Z-PINCH PLASMAS
J. S. Shlachter, J. E. Hammel, and D. W. Scudder 12 Jul. 1985 4 p Presented at the 17th Intern. Conf. on Phenomena in Ionized Gases, Budapest, 8 Jul. 1985
(Contract W-7405-eng-36)
(DE85-005818; LA-UR-85-179; CONF-850718-1) Avail: NTIS HC A02/MF A01

Early researchers recognized the desirable features of the linear Z-pinch configuration as a magnetic fusion scheme. In particular, a Z-pinch reactor might not require auxiliary heating or external field coils, and could constitute an uncomplicated, high plasma (BETA) geometry. The simple Z pinch, however, exhibited gross MHD instabilities that disrupted the plasma, and the linear Z pinch was abandoned in favor of more stable configurations. Recent advances in pulsed-power technology and an appreciation of the dynamic behavior of an ohmically heated Z pinch have led to a reexamination of the Z pinch as a workable fusion concept. DOE

N86-14060# Sandia National Labs., Albuquerque, N. Mex.
ENGINEERING DESIGN FOR THE PBFA-2 PULSE FORMING SECTION
J. D. Boyes and J. S. Cap 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-012810; SAND-84-2516C; CONF-850616-17) Avail: NTIS HC A02/MF A01

This paper presents an overview of the conceptual and detailed mechanical design of the PBFA-II Pulse Forming Section. The design goals were configuration specification, modularity for ease of installation and maintenance, durability and low cost. The design process began by determining the basic configuration. As was true throughout the design, access for ease of maintenance is a major driving factor. initial assembly requirements dictated a design of separate, modular units for the intermediate store, line one, and line two/three. Integration with the laser system used to trigger the main gas switch put location, stability and adjustment requirements on both the intermediate store and line one. Cost forced the hardware to be fabricated of aluminum. Design for ease of fabrication further held these costs down. Survival in the water shock environment was addressed through specific design and weld techniques. Critical surfaces on all components had to be capable of carrying the high voltages and currents of the machine. The design was developed through prototype testing in the one module machine, Demon. DOE

N86-14061# Oak Ridge National Lab., Tenn.
IMPACT OF A POLOIDAL DIVERTOR IN IGNITION TOKAMAK DESIGN
D. J. Strickler, Y. K. M. Peng, T. G. Brown, A. E. Dabiri, V. D. Lee, and J. B. Miller 1985 6 p Presented at the 6th Topical Meeting on the Technol. of Fusion Energy, San Francisco, 3 Mar. 1985 Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N.Y., Science Applications International Corp., Oak Ridge, Tenn., McDonnel Douglas Corp., St. Louis, Mo. and Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE85-012892; CONF-850310-106) Avail: NTIS HC A02/MF A01

System design studies were performed to assess the effect of assuming a poloidal divertor instead of a limiter as a means of impurity control for ignition tokamak configurations. Results show that for the nominal Tokamak Fusion Core Experiment (TFCX) device with superconducting TF coils, a feasible poloidal divertor configuration can be obtained without increasing the major radius. In the TFCX nominal copper TF coil device, however, field limits at the PF coils are exceeded when the effects of asymmetry associated with a poloidal divertor are included. It is found that a 12% increase in the major radius of this device is necessary to simultaneously satisfy the plasma-shaping requirements of a poloidal divertor and the magnetics constraints at the superconducting PF coils. DOE

N86-14062# GA Technologies, Inc., San Diego, Calif.
FUSION PROGRAMS IN APPLIED PLASMA PHYSICS AND DEVELOPMENT AND TECHNOLOGY, FISCAL 1984 Annual Report
T. Ohkawa Apr. 1985 63 p
(Contract DE-AT03-84ER-53158)
(DE85-014551; GA-A-17952) Avail: NTIS HC A04/MF A01

The GA programs in Applied Plasma Physics and Development and Technology have registered substantial accomplishments during fiscal 1984. Theoretical work in the MHD area has contributed to further understanding of the physics governing low-g, high-(BETA) tokamak discharges, including the effects of a cold plasma mantle and an edge-temperature pedestal. The unviersal scaling law for the maximum (BETA) stable to ideal-MHD modes has been verified for Doublet III and has also been validated for JET, DIII-D, and a Double Dee configuration. Experimental work in Applied Plasma Physics included the development of two new high-energy diagnostics, one for gamma rays and one for tritons (or, in a reactor, alpha particles), both of which can yield essential physics information that is not readily obtainable from the panoply of existing diagnostic instruments. The development of current-density profile diagnostic continued, and it was found that the instrument could also be used to obtain relative density profiles throughout a tokamak discharge. And tests of an ergodic magnetic limiter scheme indicated that the configuration has the potential to create a stable, radiating boundary layer while reducing the heat load to the walls in future high-power devices. The work carried out in the area of Development and Technology included a group of reactor systems design studies that bring into focus some of the challenges that will be faced by the engineers of fusion power equipment. Closer to realization are advanced rf equipment and superconducting magnet developments, both under design in the area of plasma technologies. Technological developments that apply directly to current experiments as well as to future devices comprise the rest of the GA D and T program.DOE

N86-14063# Wisconsin Univ., Madison.
EXPERIMENTAL STUDY OF NEOCLASSICAL CURRENTS
M. C. Zarnstorff and S. C. Prager May 1985 46 p
(Contract DE-AC02-83ER-53154)
(DE85-014866; DOE/ER-53154/82) Avail: NTIS HC A03/MF A01

A detailed experimental study is presented of the bootstrap and Pfirsch-Schlueter currents that are predicted by neoclassical transport theory. In a toroidal octupole, on magnetic surfaces within the separatrix, the observed parallel plasma currents are in excellent quantitative agreement with neoclassical theory with regard to the spatial structure (along a magnetic surface), collisionality dependence and toroidal magnetic field dependence. On magnetic surfaces outside the separatrix, the ion portion of the parallel current is in agreement with neoclassical theory but the electron parallel current is observed to obtain a unidirectional component which deviates from and exceeds the theoretical prediction. DOE

N86-14064# Brookhaven National Lab., Upton, N. Y.
EFFICIENT IONIZER FOR POLARIZED H(-) FORMATION
J. G. Alessi 1985 4 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-013294; BNL-36482; CONF-850504-161) Avail: NTIS HC A02/MF A01

An ionizer is under development for a polarized H(-) source based on the resonant charge exchange reaction polarized H(0) + D(-) (YIELDS) polarized H(-) + D(0). The polarized H(0) beam passes throughout the center of a magnetron surface-plasma soruce having an annular geometry, where it crosses a high current (approx.0.5 A), 200 eV D(-) beam. Calculations predict an H(0) (YIELDS) H(-) ionization efficiency of approx.7%, more than an order of magnitude higher than that obtained on present ground state atomic beam sources. In initial experiments using an unpolarized H(0) beam, H(-) currents in excess of 100 (MU)A have been measured. While the ionization efficiency is now only about the same as other methods (Cs beam, for example), the results are encouraging since it appears that by injecting positive ions to improve the space-charge neutralization, and by improving the extraction optics, considerable gains in intensity will be made. We will then use this ionizer with a polarized H(0) beam, and measure the polarization of the resulting H(-) beam. If no depolarization is observed this ionizer will be combined with an atomic beam, cooled to 5 to 6 K, to give a polarized H(-) beam expected to be in the milliampere range for use in the AGS. DOE

N86-14065# Sandia National Labs., Albuquerque, N. Mex.
LASER-TRIGGER SYSTEM DESIGN FOR PBFA 2
R. A. Hamil, L. C. Seamons, R. A. Gerber, R. G. Adams, J. R. Woodworth, R. S. Blackburn, and W. C. Sweatt 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013144; SAND-84-2445C; CONF-850616-39) Avail: NTIS HC A02/MF A01

A revolutionary design for triggering a multitude of high voltage gas switches is in the process of being implemented and tested at Sandia National Laboratories. This new laser triggering system for PBFA II consists of five major sybsystems. The first subsystem is a KrF laser which injects as much as 4 J of uv radiation into the optical train. The second subsystem is the optical train consisting of over 300 optical components that split the laser beam into 36 equal uv beamlets which are respectively directed into the trigger section of the PBFA-II gas switches. The third, the alignment system, provides a convenient, reliable, low cost method of sensing the degree of alignment of the KrF laser with respect to the high voltage switches. The fourth subsystem is the mechanical assembly supporting and containing the optical components in a low vibration, environmentally controlled manner. The fifth subsystem is control and diagnostics. These five subsystems act in concert to provide a low maintenance triggering system which is reliable, repeatable, repeatable in performance, and will fire the 36, 5.5-MW, PBFA-11 switches with a total firing spread first to last of 4 ns. DOE

N86-14066# Stanford Linear Accelerator Center, Calif.
GENERATION AND ACCELERATION OF HIGH INTENSITY BEAMS IN THE SLC INJECTOR
M. C. Ross, M. J. Browne, J. E. Clendenin, R. K. Jobe, J. T. Seeman, J. C. Sheppard, and R. F. Stiening Apr. 1985 3 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC08-76SF-00515)
(DE85-013056; SU-SLAC-PUB-3639; CONF-850504-76) Avail: NTIS HC A02/MF A01

A new gun pulser and substantially increased focusing have been added to the first 100 m of the SLAC linac in order to provide a pair of intense electron bunches to the SLC damping ring. Each bunch from this injector must have 5 x 10(10) electrons, an invariant emittance (GAMMA)(epsilon) less than or equal to 1.8 x 10(-3) m-rad and the pair must have an energy spread of less than 2%. Wakefield instabilities present in earlier versions of this injector have been controlled by reducing the transverse beam dimension by a factor of 3. DOE

N86-14067# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
RECENT RESULTS ON IMPLANTATION AND PERMEATION INTO FUSION REACTOR MATERIALS
R. A. Anderl, D. F. Holland, G. R. Longhurst, and D. A. Struttman 1985 25 p Presented at the 2nd Natl. Topical Meeting on Tritium Technol. in Fission, Fusion and Isotopic Appl., Dayton, Ohio, 30 Apr. 1985
(Contract DE-AC07-76ID-01570)
(DE85-014620; EGG-M-20784; CONF-850405-15) Avail: NTIS HC A02/MF A01

This paper reports on implantation-driven permeation experiments that have been made for primary candidate alloy (PCA) and the ferritic steel HT-9 using deuterium ion beams from an accelerator. The results include measurements of the implantation flux and fluence dependence of the deuterium reemission and permeation for specimens heated to approximately 430(0)C. Simultaneous measurements of the ions sputtered from the specimen front surface with a secondary ion mass spectrometer provided some characterization of the surface condition throughout an experiment. For both materials, the permeation rate was lowered by the implantation process. However, the steady state permeation rate for HT-9 was found to be at least a factor of 5 greater than that for PCA. DOE

N86-14068# Rochester Univ., N. Y. Lab. for Laser Energetics.
SCALING OF uv (351 nm) FUSION IMPLOSIONS DRIVEN BY MULTIPLE BEAMS
M. C. Richardson, J. Delettrez, R. L. McCrory, J. M. Soures, C. Verdon, and B. Yaakovi 1984 18 p Presented at the Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Boston, 27 Oct. 1984
(Contract DE-AC08-80DP-40124)
(DE85-014406; DOE/DP-40124/55; CONF-841010-19) Avail: NTIS HC A02/MF A01

The upconversion of the 24-beam OMEGA laser facility to 351 nm has permitted the study of directly driven, ablative implosions of simple spherical shell targets. Symmetric arrays of six and twelve, approx. 650 ps duration uv (351 nm) beams having total energies in excess of 600 J have been used to study the implosions of 250-350 (MU)m diameter DT-filled glass microballoon targets. Target performance is evaluated by a number of X-ray and neutronics diagnostics and compared to one- and two-dimensional hydrocode calculations. The effect of the improvement in irradiation uniformity provided by 12 beam irradiation will be described, and the expectations for 24-beam irradiated targets discussed. DOE

N86-14069# Los Alamos Scientific Lab., N. Mex.
POSSIBILITY FOR A SELF-CONSISTENT TREATMENT OF TRANSPORT PROCESSES IN A TURBULENT PLASMA
J. P. Mondt Jun. 1985 7 p
(Contract W-7405-eng-36)
(DE85-016214; LA-10464-MS) Avail: NTIS HC A02/MF A01

All commonly used models of plasma dynamics share a common flaw in their a priori validity. In particular, a solid foundation of plasma modelling on microscopic dynamics, as exists for moderately dilute gases, is obscured because of the difficulties inherent in the treatment of the potentially very important interplay between plasma waves and collisional processes. The present report briefly discusses the nature of these difficulties and presents a possible approach towards the establishment of a plasma theory founded on the microscopic particle dynamics. The essence of this approach is the realization that only discrete particle interactions can create correlations. These therefore come into being on different spatial scales depending on their cluster number, after which collective effects magnify them analogous to the growth of initial perturbations in an unstable system. Truncation of the Born-Bogolyubov-Green-Kirkwood-Yvon (BBGKY) hierarchy thereby

becomes a possibility through the introduction of a small parameter in initial conditions although the dynamical system in itself does not contain a uniformly small parameter. DOE

N86-14070# GA Technologies, Inc., San Diego, Calif.
HEATING AND CONFINEMENT IN THE DOUBLET 3 TOKAMAK WITH ELECTRON CYCLOTRON HEATING
S. Ejima, G. Jahns, S. H. Lin, C. Moeller, R. Prater, and R. Snider May 1985 6 p Presented at the 12th European Conf. on Controlled Fusion and Plasma Phys., Budapest, 2 Sep. 1985
(Contract DE-AC03-84ER-51044)
(DE85-014323; GA-4-18045; CONF-850927-5) Avail: NTIS HC A02/MF A01

Electron Cyclotron Heating (ECH) experiments on the Doublet III tokamak using inside launch of the extraordinary mode have shown effective bulk electron heating, with plasma stored energy increases of up to 30 kJ and central electron temperature increases up to 2.5 keV. The confinement time for discharges dominated by ECH was found to be similar in magnitude and scaling to that for discharges dominated by neutral beam injection, even though the power deposition profile for ECH discharges appears to be much narrower than for neutral beam heated discharges. Even above the calculated extraordinary mode cutoff density, for which the observed power density profile appears to be broad, perhaps as broad as in the beam heating case, the energy confinement time does not deteriorate. DOE

N86-13455# Joint Publications Research Service, Arlington, Va.
STRUCTURE OF FLOW OF EROSION PLASMA FORMED UPON LASER TREATMENT OF METALS Abstract Only
L. Ya. Minko, B. T. Fedyushin, Yu. A. Chivel, and A. N. Chumakov *In its* USSR Rept.: Mater. Sci. and Met. (JPRS-UMS-85-006) 29 Jul. 1985 p 24 Transl. into ENGLISH from Kvatovaya Elektron. (Moscow), v. 12, no. 3, Mar. 1985 p 639-640 (For primary document see N86-13422 04-26)
Avail: NTIS HC A05

N86-13553# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering, Acoustical Engineering and Mechanics.
ADVANCED ENERGY CONVERSION CONCEPT FOR MICROWAVE BEAMED-ENERGY PROPULSIONS Abstract Only
Leik N. Myrabo *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13554# Stuttgart Univ. (West Germany).
BASIC PROCESSES OF PLASMA PROPULSION Abstract Only
Herbert O. Schrade *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13555# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
PERFORMANCE-LIMITING FACTORS IN MPD THRUSTERS Abstract Only
Manuel Martinez-Sanchez, Daniel Heimerdinger, Mark Chanty, and David Melanson *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13556# Carnegie-Mellon Univ., Pittsburgh, Pa.
EROSION AND ONSET MECHANISMS IN MAGNETOPLASMADYNAMIC THRUSTERS Abstract Only
John L. Lawless *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13557*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAGNETOPLASMADYNAMIC THRUSTER EROSION RESEARCH Abstract Only
David Q. King *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13558# SeiTec, Cleveland, Ohio.
COMPLETELY MAGNETICALLY CONTAINED ELECTROTHERMAL THRUSTER Abstract Only
George R. Seikel *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res.Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13559*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
PLASMA-GAS INTERACTIONS STUDIES IN A HYBRID PLUME PLASMA ROCKET Abstract Only
F. R. Chang, W. A. Krueger, T. F. Yang, and J. L. Fisher (Southwest Research Inst., San Antonio, Tex.) *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 2 p Prepared in cooperation with MIT, Cambridge (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13560*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
A TANDEM MIRROR PLASMA SOURCE FOR HYBRID PLUME PLASMA STUDIES Abstract Only
T. F. Yang, F. R. Chang, R. H. Miller, K. W. Wenzel, and W. A. Krueger *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p Prepared in cooperation with MIT, Cambridge (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13561# Pennsylvania State Univ., University Park.
COUPLING BETWEEN GAS DYNAMICS AND MICROWAVE ENERGY ABSORPTION Abstract Only
Michael M. Micci *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13562# Electromagnetic Launch Research, Inc., Cambridge, Mass.
PULSED INDUCTIVE ENERGY TRANSFER Abstract Only
Peter P. Mongeau and Douglas P. Hart *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13563# Dayton Univ., Ohio. Research Inst.
LASER DIAGNOSTICS FOR ELECTRIC FIELD MEASUREMENTS Abstract Only
Roger J. Becker, Blair A. Barbour, and Alan T. Buswell *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13567# R and D Associates, Alexandria, Va.
UNIFIED STUDY OF PLASMA-SURFACE INTERACTIONS FOR SPACE POWER AND PROPULSION Abstract Only
Peter J. Turchi, John F. Davis, III, Joseph Norwood, Jr., and Craig N. Boyer *In* AFOSR The 1985 AFOSR/AFRPL Chem. Rocket Res. Meeting Feb. 1985 3 p (For primary document see N86-13507 04-28)
Avail: NTIS HC A11/MF A01

N86-13601# Joint Publications Research Service, Arlington, Va.
PRELIMINARY EXPERIMENTAL RESULTS OF CT-6B TOKAMAK HEATING FIELD VOLTAGE FEEDBACK CONTROL
Zheng Shaobai and Shen Zhongqing *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 59-64 Transl.

into ENGLISH from Kexue Tongbao (Beijing), no. 12, 1984 p 728-731 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-14145# Joint Publications Research Service, Arlington, Va.
RADIO EMISSION OF INJECTED ELECTRON BEAM WITH RESPECT TO DIAGNOSIS OF IONOSPHERIC PLASMA Abstract Only
S. A. Pulinets *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 49-50 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 807-809 Original language document announced in IAA as A85-15268 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-14071# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
AuGa2 ON GaSb(001): AN EPITAXIAL, THERMODYNAMICALLY STABILIZED METAL/3-5 COMPOUND SEMICONDUCTOR INTERFACE
J. R. Lince and R. S. Williams Aug. 1985 60 p
(Contract N00014-83-K-0612)
(AD-A157937; TR-7) Avail: NTIS HC A04/MF A01 CSCL 20/12

A new type of metal/semiconductor junction has been developed. Crystalline thin films of the intermetallic compound AuGa2 have been grown by molecular beam epitaxy on GaSb(001) substrates with the orientation AuGa2 is parallel to (0010)Ga2 is parallel to 100GaSb. The resulting films have been characterized by Auger electron spectroscopy, low energy electron diffraction, electron energy loss spectroscopy, scanning electron microscopy, X-ray microprobe analysis, and Rutherford backscattering. The growth procedure is reported, and is discussed in terms of the Au-Ga binary phase diagram. This system is of special interest for contacting technology because the compounds terminate a pseudobinary cut through the Au-Ga-Sb bulk ternary phase diagram, which minimizes the amount of chemical interaction across the metal/semiconductor interface. GRA

N86-14072# Innsbruck Univ. (Austria).
HOT ELECTRON EMISSION IN SEMICONDUCTORS Interim Report, 15 Nov. 1984 - 15 Jan. 1985
E. Gornik, R. Hoepfel, and M. Helm 15 Jan. 1985 6 p
(Contract DAJA45-84-C-0052)
(AD-A158042; R/D-4410-EE-01; IR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

The hot electron emission from low and high mobility GaAs/GaAlAs heterostructures was investigated in the FIR range at two frequencies. From the analysis a linear dependence of the electron temperature on input power per electron is found, nearly independent of the sample properties. The interaction of drifting carriers with periodic gratings in high mobility GaAs/GaAlAs systems is a promising scheme to obtain microwatt tunable FIR radiation. GRA

N86-14073# Westinghouse Research Labs., Pittsburgh, Pa.
MBE GROWTH OF CdTe AND Hg (1-x) Cd (x) Te FILMS AND MULTILAYER STRUCTURES Final Report, 1 Jan. 1983 - 31 Dec. 1984
R. F. C. Farrow, A. J. Noreika, W. J. Takei, S. Wood, and J. Greggi 16 Apr. 1985 85 p
(Contract DAAG29-83-C-0008)
(AD-A158267; Rept-85-9F3-EPCAD-R2; ARO-20202.4-EL) Avail: NTIS HC A05/MF A01 CSCL 20/2

The MBE growth of CdTe and Hg1-xCdxTe films on InSb and CdTe substrates has been investigated. Growth conditions for high-perfection CdTe films, exactly lattice-matched to InSb substrates, have been identified. These films are ideal for substrates for Hg1-xCdxTe film growth since they are free from low-angle grain boundaries and also provide electrical isolation of the Hg1-xCdxTe film from the InSb substrate. Magnetophotoconductivity studies of abrupt n-CdTe/p-InSb heterojunctions indicate the presence of an n-type inversion layer in the InSb. This could be the basis for a new type of FET device. Conditions for growth of Hg1-xCdxTe films have been explored and films of suitable quality for LWIR device fabrication have been prepared. GRA

N86-14074# Lawrence Livermore National Lab., Calif.
EQUATION OF STATE OF DENSE ARGON: A COMPARISON OF SHOCK AND STATIC STUDIES
M. Ross, H. K. Mao, P. M. Bell, and J. A. Xu Jul. 1985 7 p refs Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985 Prepared in cooperation with Carnegie Inst. of Washington, D.C.
(Contract W-7405-eng-48)
(DE85-015543; UCRL-93030; CONF-850736-45) Avail: NTIS HC A02/MF A01

In the present paper we report new diamond anvil cell (DAC) measurements for room temperature solid argon to 800 kbars. This isotherm is in excellent agreement with one predicted from a theoretical analysis of shockwave data. These results are important for several reasons. First they demonstrate agreement between shock and static techniques even in cases where shock temperatures are extremely high and a large thermal correction is required to reduce the Hugoniot to an isotherm. Secondly the results suggest that solid argon may provide a useful pressure standard up to 3 Mbar. DOE

N86-14075# California Univ., Berkeley. Lawrence Berkeley Lab.
APPLICATION OF CROSS-SECTIONAL TRANSMISSION ELECTRON MICROSCOPY TO THE CHARACTERIZATION OF ION-IMPLANTED SEMICONDUCTORS
T. Sands Mar. 1985 14 p Presented at the Joint Meeting of the Electron Microscopy Soc. of Am. and the Microbeam Anal. Soc., Louisville, Ky., 5 Aug. 1985 Prepared in cooperation with Bell Telephone Labs., Murray Hill, N.J.
(Contract DE-AC03-76SF-00098)
(DE85-010990; LBL-19162; CONF-850840-7) Avail: NTIS HC A02/MF A01

Direct implantation of dopant ions is the most precise method for obtaining a desired dopant profile in a semiconductor substrate. The most efficient approach is to understand the mechanisms of defect formation and annealing so that guidelines for choosing a set of implantation/annealing conditions can be determined. Since implantation depths are usually much less than one micron, suitable defect characterization techniques must demonstrate high spatial resolution. In this paper, the application of XTEM to understanding the origins and annealing behavior of implantation-related defects is discussed. These applications are illustrated with examples which come primarily from work done at Lawrence Berkeley Laboratory. DOE

N86-14076# Brookhaven National Lab., Upton, N. Y.
POSITRON DIFFUSION IN Si
B. Nielsen, K. G. Lynn, A. Vehanen, and P. J. Schultz Jun. 1985 4 p Presented at the 7th Intern. Conf. on Positron Annihilation, New Delhi, 6 Jan. 1985 Prepared in cooperation with Helsinki Univ. of Tech., Otaniemi, Finland and University of Western Ontario, London
(Contract DE-AC02-76CH-00016)
(DE85-014831; BNL-36700; CONF-850169-16) Avail: NTIS HC A02/MF A01

Positron diffusion in Si(100) and Si(111) has been studied using a variable energy positron beam. The positron diffusion coefficient is found to be D/sub +/ = 2.7 + or - 0.3 cm(2)/sec using a Makhov-type positron implantation profile, which is demonstrated to fit the data more reliably than the more commonly applied exponential profile. The diffusion related parameter, E0, which results from the exponential profile, is found to be 4.2 + or -

0.2 keV, significantly longer than previously reported values. A drastic reduction in E0 is found after annealing the sample at 1300 K, showing that previously reported low values of E0 are probably associated with the thermal history of the sample. DOE

N86-13606# Joint Publications Research Service, Arlington, Va.
HIGH-PRESSURE, HIGH-TEMPERATURE OPPOSED ANVIL DEVICE DESCRIBED
He Yi, Wang Songtao, Qin Zhicheng, Wang Yaoji, and Wang Wenkui *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-020) 24 Jun. 1985 p 96-99 Transl. into ENGLISH from Wuli (Beijing), v. 14, no. 1, Jan. 1985 p 38-39 (For primary document see N86-13600 04-31)
Avail: NTIS HC A09/MF A01

N86-13613# Joint Publications Research Service, Arlington, Va.
EXCIMER LASER PRODUCES .2 MICRON SEMICONDUCTOR STRUCTURES
In its West Europe Rept.: Sci. and Technol. (JPRS-WST-85-030) 28 Oct. 1985 p 37 Transl. into ENGLISH from Chem. Rundschau (West Germany), 31 May 1985 p 5 (For primary document see N86-13610 04-31)
Avail: NTIS HC A04/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-14077# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
CREF: AN EDITING FACILITY FOR MANAGING STRUCTURED TEXT
K. M. Pitman Feb. 1985 26 p
(Contract N00014-80-C-0505; Grant NSF MCS-79-12179)
(AD-A158155; AI-M-829) Avail: NTIS HC A03/MF A01 CSCL 05/8

This paper reports work in progress on an experimental text editor called CREF, the Cross Referenced Editing Facility. CREF deals with chunks of text, called segments, which may have associated features such as keywords or various kinds of links to other segments. Text in CREF is organized into linear collections for normal browsing. The use of summary and cross-reference links in CREF allows the imposition of an auxiliary network structure upon the text which can be useful for zooming in and out or non-local transitions. Although it was designed as a tool for use in complex protocol analysis by a Knowledge Engineer's Assitant, CREF has many interesting features which should make it suitable for a wide variety of applications, including browsing, program editing, document preparation, and mail reading. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-14078*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
THE 1983 NASA/ASEE SUMMER FACULTY FELLOWSHIP RESEARCH PROGRAM RESEARCH REPORTS Final Reports
Walter J. Horn, ed. (Texas A&M Univ., College Station) and Michael B. Duke, ed. Sep. 1983 409 p refs Program held in College Station, Tex., 1983
(Grant NGT-44-001-800)
(NASA-CR-171904; NAS 1.26:171904) Avail: NTIS HC A18/MF A01 CSCL 05I

The 1983 NASA/ASEE Summary Faculty Fellowship Research Program was conducted by Texas A&M University and the Lyndon B. Johnson Space Center (JSC). The 10-week program was operated under the auspices of the American Society for Engineering Education (ASEE). The basic objectives of the programs, which began in 1965 at JSC and in 1964 nationally, are (1) to further the professional knowledge of qualified engineering and science faculty members, (2) to stimulate an exchange of ideas between participants and NASA, (3) to enrich and refresh the research and teaching activities of participants' institutions, and (4) to contribute to the research objectives of the NASA Centers. The faculty fellows spent 10 weeks at JSC engaged in a research project commensurate with their interests and background. They worked in collaboration with a NASA/JSC colleague. This document

is a compilation of final reports on their research during the summer of 1983. For individual titles, see N86-14079 through N86-14105.

N86-14079*# University of Southwestern Louisiana, Lafayette. Dept. of Mathematics and Statistics.
ESTIMATION OF FINITE MIXTURES USING THE EMPIRICAL CHARACTERISTIC FUNCTION Final Report c64
Charles Anderson and Thomas Boullion *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1985 7 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

A problem which occurs in analyzing LANDSAT scenes is the problem of separating the components of a finite mixture of several distinct probability distributions. A review of the literature indicates this is a problem which occurs in many disciplines, such as engineering, biology, physiology and economics. Many approaches to this problem have appeared in the literature; however, most are very restrictive in their assumptions or have met with only a limited degree of success when applied to realistic situations. A proceudre is investigated with combines the k-L procedure of (Feurverger and McDunnough, 1981) with the MAICE procedure of (Akaike, 1974). The feasibility of this approach is being investigated numerically via the development of a computer software package enabling a simulation study and comparison with other procedures. Author

N86-14080*# Fayetteville State Univ., N.C. Dept. of Biology.
THE SCANNING ELECTRON MICROSCOPE AS A TOOL IN SPACE BIOLOGY Final Report c51
Roy A. Barrett *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06B

Normal erythrocytes are disc-shaped and are referred to here descriptively as discocytes. Several morphologically variant forms occur nomally but in rather small amounts, usually less than one percent of total. It has been shown though, that spiculed variant forms referred to as echinocytes are generated in significant amounts at zero g. Normal red cells have been stressed in vitro in an effort to duplicate the observed discocyte-echinocyte transformation at zero g. The significance of this transformation to extended stay in space and some of the plausible reasons for this transformation are discussed. Author

N86-14081*# Houston Univ., Clear Lake, Tex. Programs in Science.
ELECTRON MICROSCOPIC OBSERVATIONS OF HYDROGEN IMPLANTATION IN ILMENITES Final Report c25
Goerge E. Blanford *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 07D

Hydrogen ion beams were found to form submicrometer, bumpy textures on the surface of ilmenite grains. From this effect, it is believed that similar bumpy textures seen on lunar ilmenite, pyroxene, and olivine grains are likely to be caused by solar wind irradiation. As a consequence, the concentration of bumpy textured grains may be a useful index of surface maturity for lunar soils. An attempt was made to search for grains with these bumpy textures in interplanetary dust and lunar and meteoritic regolith breccias in order to obtain information about the duration of their exposure to the solar wind. Solar wind irradiation was simulated on natural, terrestrial ilmenite. Hydrogen ion beams were directed at small grains and polished sections which were then examined by electron microscopy. B.W.

N86-14082*# Arkansas Coll., Batesville.
A PYROLOYSIS TECHNIQUE FOR DETERMINING MICROAMOUNTS OF HYDROGEN IN LUNAR SOIL USING THE HELIUM IONIZATION DETECTOR Final Report c25
Roberta Bustin *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 13 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 07D

A method has been developed which will determine hydrogen in sub-milligram samples of lunar soil. It consists of heating the sample in a pyroprobe followed by the gas chromatographic determination of hydrogen using the helium ionization detector. Using a 7 foot, 1/8 OD stainless steel column packed with Carbosieve S, 120/140 mesh, hydrogen was well-separated from the other gases released from lunar soil. Standards of hydrogen in helium were used for calibration. The limit to detection under the conditions used was about 2 ng. The method was linear from 2 ng to 270 ng. The method was checked using some actual lunar samples. Results were typical of those obtained for lunar soils using other methods. Author

N86-14083*# Arkansas Univ., Little Rock.
FINITE ELEMENT OR GALERKIN TYPE SEMIDISCRETE SCHEMES Final Report c64
Kanat Durgun *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 14 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

A finite element of Galerkin type semidiscrete method is proposed for numerical solution of a linear hyperbolic partial differential equation. The question of stability is reduced to the stability of a system of ordinary differential equations for which Dahlquist theory applied. Results of separating the part of numerical solution which causes the spurious oscillation near shock-like response of semidiscrete scheme to a step function initial condition are presented. In general all methods produce such oscillatory overshoots on either side of shocks. This overshoot pathology, which displays a behavior similar to Gibb's phenomena of Fourier series, is explained on the basis of dispersion of separated Fourier components which relies on linearized theory to be satisfactory. Expository results represented. B.W.

N86-14084*# Alabama State Univ., Montgomery.
DETERMINATION OF NEUTRON FLUX DISTRIBUTION BY USING ANISN, A ONE-DIMENSIONAL DISCRETE S SUB n ORDINATES TRANSPORT CODE WITH ANISOTROPIC SCATTERING Final Report c72
Susanta K. Ghorai *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 18 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20H

The purpose of this project was to use a one-dimensional discrete coordinates transport code called ANISN in order to determine the energy-angle-spatial distribution of neutrons in a 6-feet cube rock box which houses a D-T neutron generator at its center. The project was two-fold. The first phase of the project involved adaptation of the ANISN code written for an IBM 360/75/91 computer to the UNIVAC system at JSC. The second phase of the project was to use the code with proper geometry, source function and rock material composition in order to determine the neutron flux distribution around the rock box when a 14.1 MeV neutron generator placed at its center is activated. Author

N86-14085*# American Univ., Beirut (Lebanon).
A STUDY OF SOME FEATURES OF ac AND dc ELECTRIC POWER SYSTEMS FOR A SPACE STATION Final Report c20
Jack I. Hanania *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 22B

This study analyzes certain selected topics in rival dc and high frequency ac electric power systems for a Space Station. The interaction between the Space Station and the plasma

environment is analyzed, leading to a limit on the voltage for the solar array and a potential problem with resonance coupling at high frequencies. Certain problems are pointed out in the concept of a rotary transformer, and further development work is indicated in connection with dc circuit switching, special design of a transmission conductor for the ac system, and electric motors. The question of electric shock hazards, particularly at high frequency, is also explored. and a problem with reduced skin resistance and therefore increased hazard with high frequency ac is pointed out. The study concludes with a comparison of the main advantages and disadvantages of the two rival systems, and it is suggested that the choice between the two should be made after further studies and development work are completed. Author

N86-14086*# East Carolina Univ., Greenville, N.C.
NUTRITIONAL CHARACTERISTICS OF MOON DUST FOR SOIL MICROORGANISMS Final Report c91
Takeru Ito *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 17 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03B

Approximately 46% of the lunar sample (10084,151), 125. 42 mg, was solubilized in 680 ml 0.01 M salicylic acid. Atomic absorption spectroscopic analysis of the solubilized lunar sample showed the following amount of metal ions: Ca, 3.1; Mg, 4.0; K, 0.09; Na, 0.67; Fe, 7.3; Mn, 1.6; Cu, Ni, Cr, less than 0.1 each. All are in ppm. Salicylic acid used to solubilize the lunar sample was highly inhibitory to the growth of mixed soil microbes. However, the mineral part of the lunar extract stimulated the growth. For optimal growth of the soil microbes the following nutrients must be added to the moon extract; sources of carbon, nitrogen, sulfur, phosphorus, and magnesium in addition to water. Author

N86-14087*# Saint Thomas Univ., Houston, Tex. Dept. of Physics.
SOME APPLICATIONS OF LIE GROUPS IN ASTRODYNAMICS Final Report c90
A. A. Jackson *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 10 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03B

Differential equations that arise in astrodynamics are examined from the standpoint of Lie group theory. A summary of the Lie method is given for first degree differential equations. The Kepler problem in Hamiltonian form is treated by this method. Extension of the Lie method to optimal trajectories is outlined. Author

N86-14088*# North Texas State Univ., Denton. Dept. of Biological Sciences.
INTERACTION BETWEEN ESCHERICHIA COLI AND LUNAR FINES Final Report c51
Karl R. Johansson *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 21 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06B

A sample of mature lunar fines (10084.151) was solubilized to a high degree (about 17 percent) by the chelating agent salicylic acid (0.01. M). The neutralized (pH adjusted to 7.0) leachate was found to inhibit the growth of Escherichia coli (ATCC 259922) in a minimial mineral salts glucose medium; however, the inhibition was somewhat less than that caused by neutralized salicylic acid alone. The presence of lunar fines in the minimal medium was highly stimulatory to growth of E. coli following an early inhibitory response. The bacterium survived less well in the lunar leachate than in distilled water, no doubt because of the salicylate. It was concluded that the sample of lunar soil tested has nutritional value to E. coli and that certain products of fermentation helped to solubilize the lunar soil. Author

N86-14089*# Middlesex County Coll., N.J. Dept. of Mech./Civil Technology.
SPECTRAL REFLECTANCE OF SURFACE SOILS: RELATIONSHIPS WITH SOME SOIL PROPERTIES Final Report c74
Carl H. Kiesewetter *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 27 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20F

Using a published atlas of reflectance curves and physicochemical properties of soils, a statistical analysis was carried out. Reflectance bands which corresporid to five of the wavebands used by NASA's Thematic Mapper were examined for relationships to specific soil properties. The properties considered in this study include: Sand Content, Silt Content, Clay Content, Organic Matter Content, Cation Exchange Capacity, Iron Oxide Content and Moisture Content. Regression of these seven properties on the mean values of five TM bands produced results that indicate that the predictability of the properties can be increased by stratifying the data. The data was stratified by parent material, taxonomic order, temperature zone, moisture zone and climate (combined temperature and moisture). The best results were obtained when the sample was examined by climatic classes. The middle Infra-red bands, 5 and 7, as well as the visible bands, 2 and 3, are significant in the model. The near Infra-red band, band 4, is almost as useful and should be included in any studies. General linear modeling procedures examined relationships of the seven properties with certain wavebands in the stratified samples. B.W.

N86-14090*# Houston Univ., Tex. Dept. of Electrical Engineering.
CONTROL OF SPACE STATIONS Final Report c18
Kwang Y. Lee *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 8 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 22B

A study is made to develop controllers for the NASA-JSC Triangular Space Station and evaluate their performances to make recommendations for structural design and/or control alternatives. The control system design assumes the rigid body of the Space Station and developes the lumped parameter control system by using the Inverse Optimal Control Theory. In order to evaluate the performance of the control system, a Parameter Estimation algorithm is being developed which will be used in modeling an equivalent but simpler Space Station model. Finally, a scaled version of the Space Station is being built for the purpose of physical experiments to evaluate the control system performance. Author

N86-14091*# Missouri Univ., Columbia. Dept. of Chemical Engineering.
SOLID WASTE TREATMENT PROCESSES FOR SPACE STATION Final Report c54
Thomas R. Marrero *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 55 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06K

The purpose of this study was to evaluate the state-of-the-art of solid waste(s) treatment processes applicable to a Space Station. From the review of available information a source term model for solid wastes was determined. An overall system is proposed to treat solid wastes under constraints of zero-gravity and zero-leakage. This study contains discussion of more promising potential treatment processes, including supercritical water oxidation, wet air (oxygen) oxidation, and chemical oxidation. A low pressure, batch-type treament process is recommended. Processes needed for pretreatment and post-treatment are hardware already developed for space operations. The overall solid waste management system should minimize transfer of wastes from their collection point to treatment vessel. Author

N86-14092*# Southwestern Univ., Georgetown, Tex.
LUNAR LUMINESCENCE MEASUREMENTS Final Report c89
Thomas H. Morgan *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 11 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03A

Spectra of lunar sites obtained in June 1983 have been analyzed for residual luminescence using the spectral line depth technique. The results or three sites each at three wavelengths are presented. The sites observed were Mare Crisium, Kepler, and Aristarchus. In each case, the value quoted was based not only on the strong Fraunhofer line in the spectral range covered but also on from 11 to 21 weaker lines within 80 A of the strongest feature. These data do not support previous observations. The values given do not indicate a greatly reddened spectrum, and the luminescence spectrum of the mare site is not significantly different from the two young crater sites. These observations cannot be adequately explained by thermal luminescence, theories of direct excitation are also unable to explain the strength of the flux. Author

N86-14093*# Sam Houston State Univ., Huntsville, Tex. Dept. of Physics.
DEVELOPMENT OF A MASS SPECTROMETER SYSTEM FOR THE MEASUREMENT OF INERT GASES IN METEORITES Final Report c90
Russell L. Palma *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03B

The study of the inert gases in meteorites has provided many clues as to the origin and evolution of the solar system. Particularly crucial and complex are the gases krypton and xenon. To accurately measure the isotopic compositions of these gases requires a mass spectrometer of high sensitivity and resolution. A previously unused and largely untested mass spectrometer system was brought to the point where it was ready for routine sample analyses. This involved, among other things, focusing the ion beam for optimal peak shape and sensitivity, documenting the instrument's response to a series of characteristic tests such as multplier gain checks, and interfacing the instrument to a computer to run the sample analyses. Following this testing and setting up, three iron meteorite samples were to be analyzed for argon, krypton, and xenon. The three samples were shown in prior work to possibly contain primordial heavy inert gases. Although these analyses have not yet been carried out, it is anticipated that they will be completed in the near future. Author

N86-14094*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
AN ANALYSIS OF CRYOTRAP HEAT EXCHANGER PERFORMANCE TEST DATA (400 AREA) AND RECOMMENDATIONS FOR A SYSTEM TO HANDLE APOLLO RCS ENGINES Final Report c34
Allen Rakow *In its* The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20D

The current arrangement of a Platecoil heat exchanger which uses LN2 on the inside of parallel tubes, in counter flow to the test cell engine exhaust gases which are drawn through a box surrounding the plates by the existing vacuum blowers is examined. As a result of inadequate performance and special test data it was decided to redesign the system to accommodate an Apollo RCS engine. G.L.C.

N86-14095*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
FLUORINE DISPOSAL c14
Allen Rakow *In its* The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 23 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 14B

A preliminary design of an F2 dispoal system for HELSTF is presented along with recommendations on operational policy and identification of potential operational problems. The analysis is based on sizing a system to handle two different modes of the HELSTF Fluorine Flow System (one operational and one catastrophic). This information should serve both as a guide to a final detailed design for HELSTF as well as a reference for subsequent monitoring and/or modification of the system which consists of a charcoal reactor followed by a dry soda lime scrubber. Author

N86-14096*# National Aeronautics and Space Administration. Johnson (Lyndon B.) Space Center,
SPARGER SYSTEM FOR MMH-HELIUM VENTS Final Report c34
Allen Rakow *In its* The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 17 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 20D

Based on a calculated vent flow rate and MMH concentration, a TI-59 program was run to determine total sparger hole area for a given sparger inlet pressure. Hole diameter is determined from a mass transfer analysis in the holding tank to achieve complete capture of MMH. In addition, based on oxidation kinetics and vapor pressure data, MMh atmospheric concentrations are determined 2 ft above the holding tank. Author

N86-14097*# Morgan State Univ., Baltimore, Md.
COMPARATIVE EFFECT OF LUNAR FINES AND TERRESTRIAL ASH ON THE GROWTH OF A BLUE-GREEN ALGA AND GERMINATING RADISH SEED Final Report c51
Esther J. Ridley *In* NASA. Johnson (Lydon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 06B

Although it is understood that photosynthetic organisms will be required as components of a closed ecological life support system (CELSS) for a manned lunar based, a basic problem is to identify organisms best capable of utilizing lunar regolith materials. Also, there is need to determine what nutrient supplements have to be added to lunar soils, and at what levels in order to promote high bio-mass production. Author

N86-14098*# Texas A&M Univ., College Station. Dept. of Meteorology.
VARIABILITY OF RAINFALL OVER SMALL AREAS Final Report c47
Robert C. Runnels *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 7 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 04B

A preliminary investigation was made to determine estimates of the number of raingauges needed in order to measure the variability of rainfall in time and space over small areas (approximately 40 sq miles). The literature on rainfall variability was examined and the types of empirical relationships used to relate rainfall variations to meteorological and catchment-area characteristics were considered. Relations between the coefficient of variation and areal-mean rainfall and area have been used by several investigators. These parameters seemed reasonable ones to use in any future study of rainfall variations. From a knowledge of an appropriate coefficient of variation (determined by the above-mentioned relations) the number rain gauges needed for the precise determination of areal-mean rainfall may be calculated by statistical estimation theory. The number gauges needed to measure the coefficient of variation over a 40 sq miles area, with varying degrees of error, was found to range from 264 (10% error, mean precipitation = 0.1 in) to about 2 (100% error, mean precipitation = 0.1 in). Author

N86-14099*# Houston Baptist Univ., Tex. Dept. of Mathematics and Physics.
TRANSFORMATION MATRICES BETWEEN NON-LINEAR AND LINEAR DIFFERENTIAL EQUATIONS Final Report c64
Robert L. Sartain *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 15 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

In the linearization of systems of non-linear differential equations, those systems which can be exactly transformed into the second order linear differential equation Y'-AY'-BY=0 where Y, Y', and Y' are n x 1 vectors and A and B are constant n x n matrices of real numbers were considered. The 2n x 2n matrix was used to transform the above matrix equation into the first order matrix equation X' = MX. Specially the matrix M and the conditions which will diagonalize or triangularize M were studied. Transformation matrices P and P sub -1 were used to accomplish this diagonalization or triangularization to return to the solution of the second order matrix differential equation system from the first order system. Author

N86-14100*# Abilene Christian Coll., Tex.
ION BOMBARDMENT AND ADSORPTION STUDIES ON ILMENITE (FeTiO3) BY X-RAY PHOTOELECTRON SPECTROSCOPY Final Report c72
Paul D. Schulze *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Research Program Research Reports Sep. 1983 10 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 08H

The effects of 5 KeV argon and oxygen ion bombardment on FeTiO3 (ilmenite) at low temperatures have been studied using X-ray photoelectron spectroscopy (XPS). Also, using this same technique, the adsorption of O2, NO, N2O, and CO at 300 K and the adsorption of O2 and D2O at 150K have been studied. Argon and oxygen ion bombardment of ilmenite have confirmed earlier studies on metal oxides that argon ions generally reduce the anion species while oxygen ions generally oxidize the anion species. The two iron states involved were Fe sup +2 and Fe sup O. The reduction of Ti sup +4 was not verified although a significant shift in the Ti(2p1,3) binding energies toward the metallic state was observed after oxygen ion bombardment at low temperatures. At temperatures above 150K, O2 adsorbs dissociatively on ilmenite while D2O adsorbs molecularly below 170K. Above 300 K No, N2O, and CO do not appear to adsorb dissociatively. Low temperature adsorption of D2O was found to be inhibited by predosing the ilmenite with O2. Author

N86-14101*# Texas Univ., Austin. Dept. of Aerospace and Engineering.
ADVANCED ALGORITHM FOR ORBIT COMPUTATION Final Report c64
Victor Szenbehely *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 17 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

Computational and analytical techniques which simplify the solution of complex problems in orbit mechanics, Astrodynamics and Celestial Mechanics were developed. The major tool of the simplification is the substitution of transformations in place of numerical or analytical integrations. In this way the rather complicated equations of orbit mechanics might sometimes be reduced to linear equations representing harmonic oscillators with constant coefficients. Author

N86-14102*# Prairie View Agricultural and Mechanical Coll., Tex.
SOLAR CONCENTRATOR DEGRADATION IN LOW EARTH ORBIT (LEO) Final Report c44
Richard G. Thomas *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 12 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 12A

The use of parabolically or spherically-shaped mirrors is being considered in order to increase the solar energy intensity on solar cells. Their use will significantly decrease the size and number of the cells needed for a particular application, hence the total array cost. Questions arise, however, regarding the long-term (five to ten years) efficiency of these devices. Performance degradation of the mirror surfaces might result from known hostile elements in the low earth orbit (LEO) environment (150-350 nautical miles). The degradation issue is addressed in light of present knowledge of this environment. The following characteristics of the LEO environment are identified for study: (1) the vacuum of space; (2) sputtering by the residual atoms and particles in space; (3) solar electromagnetic radiation; (4) contamination of the mirror surface; (5) atomic oxygen interactions with the surface; (6) bombardment of the surface by meteoroids; and (7) irradiation of the surface by ionizing particles (protons). Using the best available information for the magnitudes of the necessary quantities, a mathematical analysis was carried out, where possible, to determine the degradation in reflectance or other loss caused by each characteristic. Otherwise, reasonable estimates are made of corresponding losses, based on already published data. Author

N86-14103*# Mississippi Valley State Univ., Itta Bena.
FORTRAN PLOTTING SUBROUTINES FOR THE SPACE PLASMA LABORATORY Final Report c61
Raymond Williams *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 8 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 09B

The computer program known as PLOTRW was custom made to satisfy some of the graphics requirements for the data collected in the Space Plasma Laboratory at the Johnson Space Center (JSC). The general requirements for the program were as follows: (1) all subroutines shall be callable through a FORTRAN source program; (2) all graphs shall fill one page and be properly labeled; (3) there shall be options for linear axes and logarithmic axes; (4) each axis shall have tick marks equally spaced with numeric values printed at the beginning tick mark and at the last tick mark; and (5) there shall be three options for plotting. These are: (1) point plot, (2) line plot and (3) point-line plot. The subroutines were written in FORTRAN IV for the LSI-11 Digital equipment Corporation (DEC) Computer. The program is now operational and can be run on any TEKTRONICX graphics terminal that uses a DEC Real-Time-11 (RT-11) operating system. Author

N86-14104*# Bradley Univ., Peoria, Ill. Dept. of Mathematics.
COMPUTER GRAPHICS APPLICATIONS TO CREW DISPLAYS Final Report c61
Joan Wyzkoski *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 10 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 09B

Astronauts are provided much data and information via the monochrome CRT displays on the orbiter. For this project two areas were investigated for the possible introduction of computer graphics to enhance and extend the utility of these displays. One involved reviewing the current orbiter displays and identifying those which could be improved via computer graphics. As an example, the tabular data on electrical power distribution and control was enhanced by the addition of color and bar charts. The other dealt with the development of an aid to berthing a payload with the Remote Manipulator System (RMS). This aid consists of a graphics display of the top, front and side views of the payload and cargo bay and point of resolution (POR) position and attitude data for the current location of the payload. The initial implementation was on an IBM PC clone. The demonstration software installed in the Johnson Space Center Manipulator Development Facility (MD) was reviewed. Due to current hardware limitations, the MDF verision is slow, i.e., about a 40+ seond update rate and, hence, not real-time. Despite this fact, the evaluation of this additional visual cue as an

RMS operator aid indicates that this display, with modifications for speed, etc., can assist the crew. Further development is appropriate. Author

N86-14105*# East Texas State Univ., Commerce. Dept. of Computer Science.
SIGNAL PROCESSING OF ANTHROPOMETRIC DATA Final Report c32
Wayne J. Zimmermann *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 17B

The Anthropometric Measurements Laboratory has accumulated a large body of data from a number of previous experiments. The data is very noisy, therefore it requires the application of some signal processing schemes. Moreover, it was not regarded as time series measurements but as positional information; hence, the data is stored as coordinate points as defined by the motion of the human body. The accumulated data defines two groups or classes. Some of the data was collected from an experiment designed to measure the flexibility of the limbs, referred to as radial movement. The remaining data was collected from experiments designed to determine the surface of the reach envelope. An interactive signal processing package was designed and implemented. Since the data does not include time this package does not include a time series element. Presently the results is restricted to processing data obtained from those experiments designed to measure flexibility. Author

N86-14106*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STIRLING ENGINE SUPPORTING RESEARCH AND TECHNOLOGY Final Report
William A. Tomazic 1985 19 p Presented at the 23rd Automotive Technology Development Contractors' Coordination Meeting, Dearborn, Mich., 21-24 Oct. 1985; sponsored by DOE
(Contract DE-AI01-85CE-50112)
(NASA-TM-87175; DOE/NASA/50112-60; E-2821; NAS 1.15:87175) Avail: NTIS HC A02/MF A01 CSCL 10B

The supporting research and technology effort is intended to provide technical support to the current engine program and also to investigate advanced concepts for the next generation of Stirling engines. Technical areas represented are: seals, materials, engine experiments, combustion, system analysis, cseramics, and tribology. A collage of more recent work in each area is presented. Under seals, analysis and some experimental data on the effect of wear on rod seal performance is presented. The material work described concerns the effect of water content on hydrogen permeation. Results of experiments with the Philips' Advenco engine are presented. A comparison is made of two combustor nozzles, an air atomizing and an ultrasonic atomizing nozzle. A new venture in systems analysis to provide more rigorous Stirling engine simulation is discussed. The results of hydrogen corrosion tests on silicon carbide are presented. Friction and wear tests on candidate materials for engine hot ring tests are discussed. Author

N86-14107 Polish Academy of Sciences, Warsaw.
SCIENTIFIC ACTIVITIES OF THE POLISH ACADEMY OF SCIENCES: INSTITUTE OF FUNDAMENTAL TECHNOLOGICAL RESEARCH IN 1983
Zenon Mroz, ed., Julian Duputat, ed., Aleksandra Krolikowska, ed., and Kasimierz Sobczyk, ed. 1985 249 p
(ISBN-83-01-06288-6; ISSN-0079-523X) Copyright. Avail: Issuing Activity

The Institute of Fundamental Technological Research of the Polish Academy of Sciences (IFTR, PASc) conducts fundamental research and its practical applications in many fields of science and technology. Its principal research areas are: mathematical and physical foundations of the theory of continuous media; mechanics of material behavior in elastic and plastic ranges taking into account plasticity effects, degradation and fracture (metals, soils, rocks, concretes, polymers, composites etc.); mechanics of machinery and civil engineering structures in both linear and non-linear ranges; generation, propagation and properties of acoustic and electromagnetic waves; ultrasonic medical diagnostics; atomic frequency standards; and non-destructive testing of materials and structures. F.M.R.

N86-14108# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES, VOLUME 39, NUMBER 7 Monthly Report
L. E. Shaffer Jul. 1985 72 p
(AD-A157708; ESN-39-7) Avail: NTIS HC A04/MF A01 CSCL 05/2

European Science Notes is a monthly publication with brief articles on recent developments in European scientific research. Topics include: Recent European Contributions to Measurement Theory in the Behavioral Sciences; Biology at ETH-Zurich--Inst. for Biotechnology; Molecular biology and biophysics; Inst. for Molecular Biology; and Biological ultrastructure research; at Electromagnetic Wave Interaction with Biological Systems; Chemistry in Europe--An overview; Research in chemistry at the Univ. Louis Pasteur, Strasbourg, France; Expert Systems; Swedish Institute for Metals Research; The Technion--Israel's premier materials research facility; Numerical Analysis at Pavia; Research on Coherent Structures in Turbulent Shear Flows at Tel Aviv Univ.; Spanish University Research in Physics; Modern Optics, Microelectronics, and Thin Films Research at Madrid. GRA

N86-14109# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES. VOLUME 39, NUMBER 9
L. E. Shaffer Sep. 1985 55 p
(AD-A158278; ESN-39-9) Avail: NTIS HC A04/MF A01 CSCL 05/2

European Science Notes is a monthly publication with brief articles on recent developments in European Scientific research. Topics include: The Cognitive Structure of Verbal Ability in Israel; Greek Studies into the Psychology of Torturers; Research in Genetics, Molecular Biology, Immunology, and Virology at Swedish Universities; Workshop on Destruction of Bacterial Spores in Food Supplies; Organic Metals Program at Ben Gurion Univ., Integrated Optics Research at Tel Aviv Univ.; Highlights of the 2nd European Conference on Atomic and Molecular Physics. GRA

88 SPACE SCIENCES (GENERAL)

N86-14110*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF THE VOLT-A SHUTTLE EXPERIMENT
William J. Bifano, John M. Bozek, and Dale C. Ferguson 1985 13 p Presented at the 18th Photovoltaic Specialists Conference, Las Vegas, Nev., 21-25 Oct. 1985; sponsored by IEEE
(NASA-TM-87169; E-2807; NAS 1.15:87169) Avail: NTIS HC A02/MF A01 CSCL 12A

The NASA Lewis Research Center (LeRC) is investigating potential problems associated with the operation of high voltage solar cell arrays in the space plasma environment. At high voltages, interactions between the solar array and the space plasma could result in unacceptable levels of electrical discharge (arcing) and/or parasitic losses (current drains from the array to the plasma). The objective of the Voltage Operating Limit Tests (VOLT-A) Shuttle bay experiment is to characterize space plasma/solar cell panel interactions in low earth orbit. VOLT-A consists of an experiment plate subassembly which contains four solar panels, an electronics subassembly and a Langmuir probe subassembly mounted on an MPESS carrier. During a given 8.25 hour data taking period (5-1/2 continuous orbits), the solar panels, which represent state-of-the-art solar cell technologies, will be sequentially subjected to bias voltages in steps ranging from minus 626 V to plus 313 V. Appropriate measurements will be made at each voltage to characterize arcing and parasitic losses. Corresponding measure-

ments of the plasma environment (plasma density, electron temperature and neutral density) will also be made. Data will be recorded on an on-board tape recorder for subsequent data reduction and analysis. Author

N86-14111# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE
30 Sep. 1985 156 p refs Transl. into ENGLISH from various Russian articles
(JPRS-USP-85-005) Avail: NTIS HC A08

Progress in USSR aerospace science and technology is reported. Topics discussed include: aerospace engineering, interplanetary sciences, life sciences, space applications, space policy and administration, and launch tables. For individual titles, see N86-14112 through N86-14199.

N86-14112# Joint Publications Research Service, Arlington, Va.
FORMING TRANSFORMATION MATRICES FOR DIFFERENT PARAMETERS OF MOTION OF CELESTIAL BODIES Abstract Only c90
A. A. Sukhanov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 24 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 819-827 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The computation of matrices for transformation of certain parameters of motion to others is discussed. These matrices are needed to evaluate the influence of small perturbations of different kinds, to study relative motion and to determine and correcting motion. The transformation matrices are not found in explicit form, but are determined by using elementary matrix operations. These expressions make it possible to compute transformation matrices for rectangular phase coordinates and 216 different systems of elements formed from the 20 most frequently used orbital osculating elements. An intermediate system of orbital elements is introduced. The simple formulas make it possible to find the values of 47,089 different transformation matrices of the desired form for the two-body problem. These matrices can be computed for orbits of any type other than linear. E.A.K.

N86-14113# Joint Publications Research Service, Arlington, Va.
FORMING ATTAINABILITY SETS IN CONTROL OF KINETIC MOMENT OF ROTATING ASYMMETRIC SOLID BODY (SPECIAL CASES) Abstract Only c90
A. V. Sarychev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 25 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 828-841 Original language document announced in IAA as A85-19902 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The controlled motion of the vector of the kinetic moment (KMV) of an asymmetric rigid body rotating about the center of mass is examined in the case where the control moment is directed along an axis fixed in the body. Attention is given to the case when this axis and the initial value of the KMV lie in a special plane-P, containing nonperiodic trajectories of the Euler equations of the free rotation of the body. In this case the controlled motion of the KMV occurs in the P-plane and is described by a two-dimensional nonlinear autonomus controlled system. Attainability manifolds for this system are constructed. B.J. (IAA)

N86-14114# Joint Publications Research Service, Arlington, Va.
METHOD FOR SOLVING TWO-POINT BOUNDARY VALUE PROBLEM FOR OPTIMIZATION OF FLIGHTS WITH LOW THRUST Abstract Only c18
A. I. Glazkov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 26 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 842-847 Original language document announced in IAA as A85-19903 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A pulse-spreading (PS) method is proposed for obtaining the initial approximation for optimal jet-powered acceleration in calculations of the low-thrust transfer trajectories of spacecraft in a central gravitational field. The PS method is shown to be superior to existing methods (particularly the transporting-trajectory method) for angular transfer distances of the order of 360 deg and large eccentricities of the initial and/or final orbits. B.J. (IAA)

N86-14115# Joint Publications Research Service, Arlington, Va.
CHOICE OF OPTIMUM BOUNDARY CONDITIONS IN SPEED OPTIMIZATION PROBLEM Abstract Only c18
S. A. Voyevodin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 26-27 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 848-857 Original language document announced in IAA as A85-19904 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Attention is given to a plane problem of time-optimal control involving the setting of a spacecraft into a specified position. The distinctive character of the approach consists in the nonuniqueness of the boundary conditions with respect to the angular coordinates, and its novelty consists in the performance for constraints on the angular velocity of the spacecraft. The optimal control is synthesized, and an analytical solution is obtained. B.J. (IAA)

N86-14116# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL MODELS OF NONSTATIONARY EDDY CURRENTS AND EDDY MOVEMENTS OF FLUID IN PROBLEMS OF ORIENTATION AND STABILIZATION OF ARTIFICIAL EARTH SATELLITES AND SPACECRAFT 2 Abstract Only c18
B. I. Rabinovich and V. M. Rogovoy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 27 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 867-874 Original language document announced in IAA as A85-19906 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A mathematical model for unsteady eddy fluid motions in the tanks of a spacecraft with a liquid propellant rocket engine is considered, assuming the tanks to be equipped with dampers in the form of sharp-edged ribs, and considering the acceleration, deceleration, and correction segments of the orbit. Allowance is made for the kinetic energy of the eddy motions. The model is shown to be identical to the model of unsteady eddy currents in a conducting ferromagnetic at a high Reynolds number, a high magnetic Reynolds number, and a low Strouhal number. The harmonic-balance method is used to reduce the models to a form convenient for solving dynamic problems of a colosed control volume regulator system. B.J. (IAA)

N86-14117# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF FLUXES OF COLD IONS FROM PLASMASPHERE INTO IONOSPHERE DURING NIGHTTIME IN MIDDLE LATITUDES Abstract Only c46
V. V. Afonin, P. Bentse, V. V. Bezrukikh, K. I. Gringauz, I. Semerei, and N. F. Smirnova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 28 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 884-888 Original language document announced in IAA as A85-19908 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Electrostatic analyzers aboard the Vertikal'-10 rocket (launched on December 25, 1981 at 22.35 MLT) detected fluxes of cold ions moving from the midlatitude plasmasphere to the ionosphere at night at L = 2. The flux velocity was observed to be approximately 1000 m/s, and the flux density was (0.8-4.0) x 10 to the 8th/sq cm s. Discrepancies between theoretical predictions and experimental observations of the flux values are discussed, and it is noted that the measured fluxes from the plasmasphere are sufficient for sustaining the nighttime ionosphere. B.J. (IAA)

N86-14118# Joint Publications Research Service, Arlington, Va.
SPECTRUM OF PHOTOELECTRONS IN EARTH'S UPPER ATMOSPHERE DURING SOLAR FLARES Abstract Only c93
S. V. Avakyan and G. S. Kudryashev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 29 Transl. into ENGLISH

from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 889-894 Original language document announced in IAA as A85-19909 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A theoretical study of variations of the energy distribution of photoelectrons in the ionosphere during solar flares is performed for the example of the flares of February 25, 1969 and December 27, 1968. The role of Auger electrons in the formation of photoelectrons with energies exceeding 150 to 200 eV is shown to be dominant. The calculation model is confirmed by experimental data on variations of photoelectron intensity and upper-atmospheric emission. It is concluded that the proposed model is suitable for determining the degree of ionospheric disturbances during flares, especially above 100 km, where the role of photoelectrons becomes drastically more significant. B.J. (IAA)

N86-14119# Joint Publications Research Service, Arlington, Va.
SOLAR FLARE X-RADIATION AND HIGH-ENERGY PARTICLES ACCORDING TO OBSERVATIONAL DATA FROM VENERA-13 AND VENERA-14 AUTOMATIC INTERPLANETARY STATIONS Abstract Only c92
S. A. Belyakov, Ye. I. Daybog, A. P. Dyachkov, V. M. Zenchenko, Viktoriya G. Kurt, Yu. I. Logachev, A. I. Rutkovskiy, S. P. Ryumin, V. G. Stolpovskiy, V. G. Yurovitskaya et al *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 30 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 906-921 Original language document announced in IAA as A85-19911 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Venera-13, 14 data obtained from November 1981 to April 1982 are used to examine the correlation between bursts of hard solar X-rays (energy exceeding 0.055 MeV) and solar-cosmic-ray (SCR) flares. Data on solar flares in H-alpha, thermal X-rays, and Type 3 radio bursts were used in the analysis. It is shown that the amplitude of flare-electron intensity (energies exceeding 1.0 MeV) is best correlated with flare importance in the thermal X-ray range (r = 0.8 + or - 0.03). The use of this importance makes it possible to construct solar-longitude dependences of flare electrons and to assess the solar-longitudinal interval of flares in which coronal-propagation effects can be neglected. A practically linear correlation is found between SCR electrons with energies of tens of keV and thermal X-rays. B.J. (IAA)

N86-14120# Joint Publications Research Service, Arlington, Va.
ROLE OF INTRINSIC ENERGY SOURCE IN PHYSICAL BEHAVIOR OF SPLIT COMETARY NUCLEUS Abstract Only c90
V. D. Davydov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 31 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 922-941 Original language document announced in IAA as A85-19912 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

It is hypothesized that the intrinsic energy of a multiple cometary nucleus (MCN) plays the dominant role in the physical behavior of especially active comets. This results from the fact that the relatively low energy of the impact mechanism is capable of sustaining the extremely high level of consumption of solar energy toward the sublilmation of cometary matter from the icy-dust cloud into the nuclear region. The intrinsic activity of the MCN gradually decays in the course of its evolution into a system with a collisionless sturcture. The sudden switch-on of the shock mechanism is associated with the removal of a tail of large clumps around the main mass of the MCN; the most simple reason for this is a powerful tidal effect on the tail. The more complex process of the switch-off of the impact mechanism follows the nontidal division of the main mass of the nucleus. B.J. (IAA)

N86-14121# Joint Publications Research Service, Arlington, Va.
APPROXIMATE SOLUTIONS OF EULER-LAMBERT EQUATION FOR CASE OF SEVERAL REVOLUTIONS ABOUT CENTRAL BODY Abstract Only c90
L. B. Livanov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 32 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 942-944 Original language document announced in IAA as A85-19913 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Approximate solutions are obtained for the Euler-Lambert equation with the aim of economizing machine time in the framework of designing fuel-optimal spacecraft trajectories. The results, obtained for several revolutions about a central body, are applicable to the Earth-Venus-Earth and Earth-Mars-Earth trajectories. B.J. (IAA)

N86-14122# Joint Publications Research Service, Arlington, Va.
FORMATION OF HIGH-ENERGY SECONDARY ELECTRONS IN LOW-DENSITY MEDIUM AT GREAT ALTITUDES Abstract Only c93
L. V. Kurnosova, L. A. Razorenov, and M. I. Fradkin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 32-33 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 947-949 Original language document announced in IAA as A85-19915 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The formation of a high-energy secondary electron halo at high altitudes (approximately 500 km) in the upper atmosphere is examined on the basis of Cosmos-225 scintillation-counter data for electron energies of 70 to 1000 and 100 to 1000 MeV. This secondary-electron flux is shown to be roughly equal to the flux of albedo electrons, which serves as a confirmation of Grigorov's (1977) model concerning the existence of a radiation belt formed of electrons with energies exceeding 100 MeV. B.J. (IAA)

N86-14123# Joint Publications Research Service, Arlington, Va.
HARD GAMMA RADIATION BACKGROUND FROM CODING COLLIMATOR OF GAMMA TELESCOPE UNDER SPACE EXPERIMENT CONDITIONS Abstract Only c93
A. P. Aleksandrov, A. N. Berezovoy, A. M. Galper, V. M. Grachev, V. V. Dmitrenko, V. G. Kirillov-Ugryumov, V. V. Lebedev, V. A. Lyakhov, A. A. Moiseyev, S. Ye. Ulin et al *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 33-34 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 950-951 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Coding collimators are used to improve the angular resolution of gamma-ray telescopes at energies above 50 MeV. However, the interaction of cosmic rays with the collimation material can lead to the appearance of a gamma-ray background flux which can have a deleterious effect on measurement efficiency. An experiment was performed on the Salyut-6-Soyuz spacecraft system with the Elena-F small-scale gamma-ray telescope in order to measure the magnitude of this background. It is shown that, even at a zenith angle of approximately zero degrees (the angle at which the gamma-ray observations are made), the coding collimator has only an insignificant effect on the background conditions. B.J. (IAA)

N86-14124# Joint Publications Research Service, Arlington, Va.
SUDDEN DISAPPEARANCE OF QUIESCENT PROMINENCES Abstract Only c92
G. P. Apushkinskiy and N. A. Topchilo *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 34 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1150-1157 Original language document announced in IAA as A85-42338 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Cases of the breakup of quiescent prominences on July 2, 1976, and July 30, 1980, are discussed. Radio and optical data at wavelengths 1.35 and 0.8 cm and in the H-alpha line, respectively, confirmed the arch structure of the prominences. The breakup took place both through expansion of the arch and as a consequence of plasma outflow through its bases, in which heat conduction played an insignificant role. Author (IAA)

N86-14125# Joint Publications Research Service, Arlington, Va.
MAGNETIC FIELD DETERMINATION IN QUIESCENT SOLAR PROMINENCES FROM POLARIZATION CHARACTERISTICS OF RADIATED LIGHT Abstract Only c92
M. G. Gornyy, D. V. Kupriyanov, and B. G. Matisov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 35 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1158-1167 Previously announced in IAA as A85-42339 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A method is proposed for the approximate solution of the equations of optical pumping describing the Hanle effect, based on the property of weak anisotropy of the exiting light, in quiescent solar prominences. The polarization characteristics of the emission of a prominence as a function of the magnitude and direction of the magnetic field are calculated on He triplet transitions. The influence of the trapping of resonance radiation on the polarization of the ensemble of emitting atoms is analyzed. Author (IAA)

N86-14126# Joint Publications Research Service, Arlington, Va.
SPATIAL PATTERNS OF MANIFESTATION OF SOLAR ACTIVITY IN TROPOSPHERE Abstract Only c92
R. V. Smirnov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 35-36 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1168-1178 Previously announced in IAA as A85-42340 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A joint analysis of maps of pressure variation in the troposphere (or of pressure dispersions) following geomagnetic disturbances and of maps of advection, wind-speed divergence, etc. makes it possible to advance the concept of solar dependent centers of action (SDCA), of the atmosphere, by means of SDCA, where baroclinic instability is high, a solar disturbance is transmitted and planetary waves develop in the atmosphere. Infrasonic waves are considered as an agent connecting the lower thermosphere and the troposphere. Author (IAA)

N86-14127# Joint Publications Research Service, Arlington, Va.
MECHANISM OF CORPUSCULAR-ATMOSPHERIC RELATIONSHIPS Abstract Only c46
E. R. Mustel *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 36-37 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1179-1183 Previously announced in IAA as A85-42341 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In this paper attention is drawn to the results of Brazilian investigators (Martin, et al., 1972; Trivedi, et al., 1973) who concluded that dumping of high-energy particles from the Earths radiation belts down toward the stratosphere occurs in the region of the south magnetic anomaly at times of geomagnetic storms. Assuming that analogous processes occur in the Northern Hemisphere and using the numerical data of the Brazilian investigators and others, it is shown that the total energy flux contained in the dumpings can reach 10 to the 24th erg. Attention is drawn to the very important fact that all four of the main climatic lows of the Northern Hemisphere (North American, Icelandic, Asiatic, and Aleutian) coincide with the main magnetic anomalies, and hence, be above-indicated dumpings of energetic particles play the main role just in the regions of magnetic anomalies and thereby in the regions of climatic lows. Author (IAA)

N86-14128# Joint Publications Research Service, Arlington, Va.
APPROXIMATE CLUSTER ANALYSIS METHOD AND THREE-DIMENSIONAL DIAGRAM OF OPTICAL CHARACTERISTICS OF LUNAR SURFACE Abstract Only c91
N. N. Yevsyukov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 37 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1184-1191 Previously announced in IAA as A85-42342 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An approximate isolation algorithm for the isolation of multidimensional clusters is developed and applied in the construction of a three-dimensional diagram of the optical characteristics of the lunar surface. The method is somewhat analogous to that of Koontz and Fukunaga (1972) and involves isolating two-dimensional clusters, adding a new characteristic, and linearizing, a cycle which is repeated a limited number of times. The lunar-surface parameters analyzed are the 620-nm albedo, the 620/380-nm color index, and the 950/620-nm index. The results are presented graphically; the reliability of the cluster-isolation process is discussed; and some correspondences between known lunar morphology and the cluster maps are indicated. T.K. (IAA)

N86-14129# Joint Publications Research Service, Arlington, Va.
STRUCTURE OF COEFFICIENTS OF SERIES REPRESENTING SOLUTION OF PLANE CIRCULAR RESTRICTED THREE-BODY PROBLEM Abstract Only c64
Ye. I. Timoshkova and V. B. Titov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 38 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1211-1217 Previously announced in IAA as A85-42346 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The properties of the trigonometric polynomials which serves as the coefficients of power series constructed by Timoshkova (1979 and 1980) to represent the first integrals of the plane circular restricted three-body problem of celestial mechanics are investigated analytically. The convergence of the power series is discussed, and it is demonstrated in numerical computations for the earth-moon system that the Jacobi constant C for collinear libration points can be determined from the formally constructed integrals. T.K. (IAA)

N86-14130# Joint Publications Research Service, Arlington, Va.
A PRIORI GUARANTEED ACCURACY EVALUATION IN DETERMINING SPACECRAFT ORBIT BY LEAST SQUARES METHOD Abstract Only c13
P. Ye. Elyasberg *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 38-39 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 643-650 Previously announced in IAA as A85-15251 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In an a priori estimation of the expected accuracy of orbit determination, it is assumed that all the initial data (measurements and a priori information concerning the parameters of the mathematical model) can be divided into groups between which and within which are specified different constraints on the correlation coefficients between errors. Formulas are derived for calculating the guaranteed value of the error of the estimate variance of any estimated parameter when performing single or repeated measurements. B.J. (IAA)

N86-14131# Joint Publications Research Service, Arlington, Va.
INTEGRATION OF EQUATIONS OF MOTION FOR MATERIAL POINT IN GRAVITATIONAL FIELD OF AXIALLY SYMMETRIC PLANET Abstract Only c90
A. R. Golikov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 39 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 651-662 Original language document announced in IAA as A85-15252 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The paper formulates a general method of searching for an anharmonic approximation expression for the gravitational potential of an axisymmetric planet, allowing integration of the equations of motion of its satellite in quadratures. Though the analysis is performed for oblate spheroidal coordinates, the possibility of using the proposed method for other systems of curved coordinates is demonstrated. B.J.(IAA)

N86-14132# Joint Publications Research Service, Arlington, Va.
PERIODIC REGIMES OF ROTATIONAL MOTION OF SOLID

BODY ABOUT LIBERATION POINT L SUB 4 IN RESTRICTED ELLIPTICAL THREE-BODY PROBLEM Abstract Only c90
Yu. V. Barkin and S. N. Lelyavin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 40 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 663-674 Original language document announced in IAA as A85-15253 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Several families of periodic solutions are obtained and analyzed for the rotational motion of a rigid body whose center of mass is situated at the L4 libration point of the restricted elliptical three-body problem. It is assumed that the ellipsoid of inertia is nearly a sphere. The investigation is based on the theory of periodic Poincaresolutions for degenerate Hamiltonian systems. B.J.(IAA)

N86-14133# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL MODELS OF NONSTATIONARY EDDY CURRENTS AND EDDY MOTIONS OF FLUID IN SPACECRAFT ORIENTATION AND STABILIZATION PROBLEMS 1 Abstract Only c18
B. I. Rabinovich and V. M. Rogovoy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 41 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 678-692 Original language document announced in IAA as A85-15255 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The paper examines the development of an adequate mathematical model for eddy currents in a conducting ferromagnetic, valid for the frequency band which characterizes spacecraft attitude and stabilization problems. The model is synthesized on the basis of the asymptotic solution of the appropriate boundary layer equations. This approach is illustrated by the model of an electromagnetic actuator for spacecraft attitude and stabilization systems. B.J.(IAA)

N86-14134# Joint Publications Research Service, Arlington, Va.
COMPARISON OF ENERGETICS OF OPTIMUM MANEUVERS AND TWO-IMPULSE MANEUVERS IN SOME PROBLEMS OF MOTION FROM A POINT INTO ORBIT Abstract Only c18
A. P. Skorokhodov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 41-42 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 693-701 Original language document announced in IAA as A85-15256 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Optimal multiple-impulse maneuvers are compared with the simplest one- and two-impulse maneuvers in terms of fuel consumption for certain problems involving the transfer of a spacecraft from a point specified by the radius vector and velocity vector into a circular orbit. It is shown that, in general, the optimal transfers are close from the standpoint of energy consumption to the simple impulse maneuvers, the gain achieved through the multiple-impulse transfers amounts to less than 1 percent. However, there are cases when the gain achieved through optimal transfers is significant. B.J.(IAA)

N86-14135# Joint Publications Research Service, Arlington, Va.
OPTIMUM CONTROL PROGRAMS IN PROBLEM OF INTERORBITAL FLIGHT WITH CONTINUOUS THRUST Abstract Only c18
S. A. Ishkov and V. V. Salmin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 42 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 702-711 Original language document announced in IAA as A85-15257 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Various thrust-vector-control programs are examined for the transfer of a spacecraft with a low-thrust engine between noncoplanar circular Keplerian orbits. The averaging method is used to obtain the model of spacecraft motion; and the optimal control program is determined which minimizes fuel consumption with allowance for constraints connected with spacecraft rotation. Calculations are made of the energy characteristics of interorbit transfers from a low geocentric orbit to a stationary satellite orbit. B.J.(IAA)

N86-14136# Joint Publications Research Service, Arlington, Va.
DISTURBANCES IN STRATOSPHERE AND MESOSPHERE FROM SOURCE OF ULTRAVIOLET RADIATION Abstract Only c46
S. I. Kozlov *In its* USSR Rept.: Space • (JPRS-USP-85-005) 30 Sep. 1985 p 43 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 712-719 Original language document announced in IAA as A85-15258 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A theoretical investigation is made of disturbances in the stratosphere and mesosphere caused by UV radiation in the 1350 to 4000 A range. It is shown that the effect of this radiation, accompanied by the photodissociation of O2 and minor neutral constituents, can produce a significant reduction in the density of negative ions and, hence, a significant increase in electron density. The effect quantitatively depends on wavelength, height, and especially the type of the principal negative ion. B.J.(IAA)

N86-14137# Joint Publications Research Service, Arlington, Va.
COORDINATED INVESTIGATIONS OF PROCESSES IN SUBAURORAL UPPER IONOSPHERE AND THROUGH IN CONCENTRATION OF LIGHT IONS Abstract Only c46
L. D. Sivtseva, V. M. Filippov, V. L. Khalipov, Yu. I. Galperin, V. A. Yershova, L. M. Nikolayenko, Yu. N. Ponomarev, and V. M. Sinitsyn *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 43-44 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 720-741 Original language document announced in IAA as A85-15259 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An analysis is made of Aureole 1 and 2 satellite data concerning latitude profiles of H(+) and He(+) ion density in the midlatitude and subauroral upper ionosphere. A description is given of measurements of subtroughs, i.e., sharp local decreases of H(+) ion density at midlatitude heights of 800 to 1500 km. Data on the location of the light-ion trough in the nightime sector are compared with measurements of the main trough and the L-shell of its polar wall in the lower F-region. L-shells of the plasmapause are shown to coincide with the diffuse-precipitation boundary during moderate disturbances. A scheme of ion convection and density at various heights in the nighttime subauroral F-region is proposed. B.J.

N86-14138# Joint Publications Research Service, Arlington, Va.
REGISTRY OF HEAVY IONS IN AURORAL REGION DURING MAGNETIC STORMS Abstract Only c46
Yu. V. Gotselyuk, S. N. Kuznetsov, and K. Kudela *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 44-45 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 742-748 Original language document announced in IAA as A85-15260 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An analysis is made of Intercosmos-17 data concerning the distribution and dynamics of fluxes of protons, alpha particles, and C, N, and O nuclei during the intense magnetic storms of October 27, and December 2, 1977. Data on the heavy ions are compared with data obtained with the Explorer-45 and S3-3 satellites. A scattering mechanism is proposed which can explain the detection of heavy ions at low altitudes. B.J. (IAA)

N86-14139# Joint Publications Research Service, Arlington, Va.
SMALL-SCALE STRUCTURE OF INTENSIVE LONGITUDINAL CURRENTS IN HIGH LATITUDES Abstract Only c46
A. S. Volokitin, V. V. Krasnoselskikh, Ye. V. Mishin, L. O. Tyurmina, V. A. Sharova, and S. I. Shkolnikova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 45 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 749-755 Original language document announced in IAA as A85-15261 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An investigation is made of the small-scale structure of field-aligned currents, detected in the auroral oval using magnetic measurements from the Intercosmos-Bulgaria 1300 satellite. The characteristic transverse size of the currents ranges from 2 to 8 km and the density ranges from 0.00003 to 0.0001 A/sq m. It is shown that some of the current structures correspond to a system of standing Alfven waves, evidently excited by the magnetospheric-convection instability. The size of the structure along the geomagnetic field and the magnitude of anomalous resistance are determined. B.J.(IAA)

N86-14140# Joint Publications Research Service, Arlington, Va.
FORMATION OF PROTON RADIATION BELTS IN REGION OF ENERGIES OF SEVERAL MeV Abstract Only c46
M. I. Panasyuk and E. N. Sosnovets *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 46 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 756-762 Original language document announced in IAA as A85-15262 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Satellite data on the spatial location of intensity peaks of radial profiles (Ljm) of protons in the energy range from 500 keV to 100 MeV near the geomagnetic equator are examined. These data are compared with calculations of Ljm(E), taking into account particle transport under the effect of geomagnetic-field fluctuations (GFF). Calculations and experimental data are shown to agree well for a GFF power spectrum having, along with the principal spectrum component Pm(nu) proportional to nu exp-p (where p is about 2), a dominant spectral component at the frequency nu in the MHz range. B.J. (IAA)

N86-14141# Joint Publications Research Service, Arlington, Va.
DEPENDENCE OF LENGTH OF FREE PATH OF FLARE PARTICLES ON ENERGY Abstract Only c90
Ye. I. Daybog, Viktoriya G. Kurt, and V. G. Stolpovskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 46-47 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 763-773 Original language document announced in IAA as A85-15263 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An analysis is made of the time profiles of fluxes of protons and alpha particles in the 0.1 to 100 MeV/nucleaon range, detected by Prognoz-6 in the solar-flare events of September 24, October 9 and 12, November 22, December 27, 1977. It is shown that a harmonic expansion of the measured field cannot be used to calculate the transport characteristics of solar cosmic rays (SCR). This is evidently due to the fact that the usual procedure for determining the power spectrum of IMF fluctuations does not make it possible to identify the type of inhomogeneity (wave, oscillation, or discontinuity) on which SCR-scattering occurs. B.J.(IAA)

N86-14142# Joint Publications Research Service, Arlington, Va.
OBSERVATION OF SMALL-SCALE SOLAR WIND STRUCTURE ON FRONT OF SHARP INCREASE IN PLASMA FLOW VELOCITY Abstract Only c92
L. A. Avanov, G. N. Zastenker, O. L. Vaysberg, and Yu. I. Yermolayev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 47-48 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 774-780 Original language document announced in IAA as A85-15264 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The Prognoz-8 Monitor device comprising two electrostatic analyzers was used to measure the energy spectra (in the 0.140 to 4.08 keV./charge range) of the ion component of the solar wind with a time resolution of 1.36 sec and, hence, to investigate the small-scale structure of the solar wind at the front of a sharp increase of plasma-stream velocity. It is shown that, in this region, there exist two plasma streams of different velocity (the velocity gradient being 50 to 70 km/s) having different flow directions. Discontinuities of the kinetic parameters of the ion component are observed over a period of 1.5 to 10 sec. B.J. (IAA)

N86-14143# Joint Publications Research Service, Arlington, Va.
ELECTRICAL AND ELECTROTHERMAL CONDUCTIVITY OF PLANETARY IONOSPHERES, 1: REFINEMENT OF THEORY Abstract Only c91
A. V. Pavlov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 48-49 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 781-791 Original language document announced in IAA as A85-15265 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The explicit form of the coefficients of the electrical and electrothermal conductivity of electrons in a magnetic field in a multicomponent ionosphere with allowance for the temperature difference between electrons and heavy constituents is determined in the first, second, and third approximations of the Sonin polynomial expansion of the Chapman-Enskog method. General expressions for the electron transport coefficients are obtained, which are reduced to a form convenient for practical application. In the first approximation, equations are derived for determining the ion diffusion velocities in a magnetic field in a multicomponent gas mixture. Approximating expressions are refined for the collision frequencies of electrons with the principal neutral constituents of the upper planetary atmospheres. Equations for determining the ambipolar-diffusion velocities of ions in a multicomponent ionosphere in the absence of a magnetic field (or parallel to it) are obtained in the first, second, and third approximations. B.J. (IAA)

N86-14144# Joint Publications Research Service, Arlington, Va.
UNIQUENESS CONDITIONS IN EVALUATION OF LEAST SQUARES METHOD IN NONLINEAR SPACE NAVIGATION PROBLEMS Abstract Only c17
G. A. Mersov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 49 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 804-807 Original language document announced in IAA as A85-15267 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A major difficulty in nonlinear problems of space navigation is the multiplicity of minima of the functional used in the least squares method. The present paper establishes conditions under which the global-minimum estimate is justified. The necessity of accounting for nonlinearity is connected with the magnitude of measurement errors and with the size of the region of a priori values of the estimated parameters. B.J. (IAA)

N86-14145# Joint Publications Research Service, Arlington, Va.
RADIO EMISSION OF INJECTED ELECTRON BEAM WITH RESPECT TO DIAGNOSIS OF IONOSPHERIC PLASMA Abstract Only c75
S. A. Pulinets *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 49-50 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 807-809 Original language document announced in IAA as A85-15268 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Data from the ARAKS electron-beam-injection experiment are reviewed. It is shown that conditions under which the beam-particle density is approximately equal to the density of the background plasma are experimentally attainable, while conditions under which the beam-particle density is much less than the density of the background plasma are unattainable. This indicates that ionospheric-plasma diagnostics using adio emission from an injected electron beam is entirely possible, but only along the rocket trajectory. B.J. (IAA)

N86-14146# Joint Publications Research Service, Arlington, Va.
CHARGE COMPOSITION OF ELECTRONS IN EARTH'S RADIATION BELT Abstract Only c46
B. I. Luchkov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 50-51 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 809-812 Original language document announced in IAA as A85-15269 (For primary document see N86-14111 04-88)

Avail: NTIS HC A08

Synchrotron-radiation data are used to investigate the charge composition of the electrons (i.e., the content of electrons and positrons) in the radiation belts of Earth and Jupiter. Possible experimental techniques for measuring the sign of high-energy electrons in the radiation belts are examined, with particular attention given to measurements of the circular polarization of synchrotron radiation. B.J. (IAA)

N86-14147# Joint Publications Research Service, Arlington, Va.
WAVE INTERPRETATION OF MEASUREMENTS ON MARS-7 AND VENERA-9 PROBES FOR DETERMINING VELOCITY OF MOTION OF INTERSTELLAR GAS Abstract Only **c90**
Ye. M. Grivnev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 51 Transl. into ENGLISH from Pisma v Astron. Zh. (Moscow), v. 10, no. 12, Dec. 1984 p 908-911 Previously announced in IAA as A85-39191 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The measurements of the velocity of interstellar gas in the solar system obtained by the Mars 7 and Venera 9 probes (Bertaux et al., 1976 and 1978) are analyzed in the framework of the density-wave theory of spiral galaxies (Lin et al., 1969), assuming that the gas motion comprises a basic circular motion, a random component arising from a nearby disturbance such as a supernova outburst, and a systematic noncircular motion induced by the gravity field of a spiral density wave. T.K. (IAA)

N86-14148# Joint Publications Research Service, Arlington, Va.
VEGA-1 RELEASES AEROSTAT AND LANDER AT VENUS **c91**
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 52-53 Transl. into ENGLISH from Komsomolskaya Pravda (Moscow), 12 Jun. 1985 p 1 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An important stage of the international project Venus-Halley's Comet has been accomplished. A fundamentally new experiment for the study of the circulation of Venus' atmosphere and of its meteorological parameters was begun on 11 June 1985. Flying a distance of approximately 500 million kilometers in six months, the Vega-1 station reached the vicinity of Venus and on 9 June released a descent module which entered the atmosphere on 11 June. This module separated into a landing module and an aerostatic probe. The aerostatic probe, whose gas bag filled with helium following the separation, is drifting in the atmosphere at an altitude of 54 kilometers. Installed on the probe are a radio-transmitting complex and scientific apparatus for measurements of parameters of Venus' atmosphere and cloud cover. B.W.

N86-14149# Joint Publications Research Service, Arlington, Va.
OBJECTIVES OF VEGA PROJECT RESEARCH Abstract Only **c91**
T. Breus *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 54 Transl. into ENGLISH from Kommunist (Moscow), 13 Jun. 1985 p 4 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The objectives and methods of meteorological and geochemical studies of the planet Venus are discussed. These studies were done by probes from the automatic interplanetary stations Vega-1 and Vega-2. These experiments called for using aerostatic probes for the first time to obtain information on the dynamics of Venus' atmosphere; determining the atmosphere's sulfuric acid content by direct methods for the first time; obtaining new data on the chemical composition and structure of clouds of Venus and on trace elements in the planet's atmosphere; and determining the element composition of the planet's soil in new locations, with the aid of the stations' landing modules. B.W.

N86-14150# Joint Publications Research Service, Arlington, Va.
VEGA-2 RELEASES AEROSTAT AND LANDER AT VENUS **c91**
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 55-56 Transl. into ENGLISH from Komsomolskaya Pravda (Moscow), 16 Jun. 1985 p 1 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

On 15 June 1985, the automatic interplanetary station Vega-2 released landing module and an independent aerostatic probe into the planet's atmosphere. The station has passed beyond Venus to a distance of 24,500 kilometers from its surface and is continuing its flight toward Halley's Comet. On 13 June a descent module separated from the station as it was approaching Venus. This module separated into an aerostatic probe and a landing module on 15 June. Soviet and international networks of ground radio telescopes are receiving information from the probe, which is equipped with a unique radio system, and they are fixing its coordinates and rate of movement. The landing module made a soft landing on the dark side of Venus. The composition and physical characteristics of the atmosphere were studied as the module descended through it. B.W.

N86-14151# Joint Publications Research Service, Arlington, Va.
RESULTS FROM VEGA ATMOSPHERE AND SOIL STUDIES Abstract Only **c91**
V. Golovachev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 57 Transl. into ENGLISH from Trud (Moscow), 16 Jun. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Data on the atmosphere and soil of the planet Venus received from the aerostatic probe and landing module delivered by the Vega-2 space station are discussed. It is noted that earlier studies of surface rocks on Venus showed that they are intermediate between basalts and granites with respect to content of natural radio-active elements; their feature differ depending on location, however. Quick analysis of the sample taken in the Rusalki plain area indicated that it was soft soil with a compressive strength similar to that of loose andesite-basalt soils on Earth. B.W.

N86-14152# Joint Publications Research Service, Arlington, Va.
PRESS CONFERENCE ON FIRST STAGE OF VEGA PROJECT **c91**
V. P. Ovcharov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 58-59 Transl. into ENGLISH from Sov. Latviya (Riga), 18 Jun. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

An unusual phenomenon--the rapid rotation of Venus' cloud layer around the planet--has received reliable experimental confirmation. The second station flew by Venus on its way to Halley's Comet. Unique scientific information has been transmitted to Earth with the aid of instruments delivered by Vega-1 and Vega-2. The first of these aerostatic probes, which was in flight for 46 hours and traveled more than 10,000 kilometers in the planet's atmosphere, transmitted information which indicates that the clouds carried it around Venus at a rate of 60 to 70 meters a second. The significance of this data to the understanding of the Venusian atmosphere is discussed. B.W.

N86-14153# Joint Publications Research Service, Arlington, Va.
FURTHER COMMENTS ON RESULTS OF VEGA STUDIES OF VENUS Abstract Only **c91**
A. Pokrovskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 60 Transl. into ENGLISH from Pravda (Moscow), 1 Jul. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

This article records comments of specialists involved in the Venus probe segment of the Vega project. Results of measurements with the landers and aerostats that were dropped on Venus from the space stations are discussed. B.W.

N86-14154# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF INSTRUMENTS FOR VEGA PROBES Abstract Only **c19**
A. Barshay *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 61 Transl. into ENGLISH from Sov. Kirgiziya

(Frunze), 22 Jun. 1985 p 4 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The development of instruments for the Vega-1 and Vega-2 interplanetary stations is discussed. These instruments were designed for use on landing modules intended for studies of Venus. One of these instruments, the VPD-AV, is intended for controlling all operations for placing aerostatic probes into Venus' atmosphere following their separation from the stations' landing modules. Commands issued by this high-precision, preprogrammed timing device were formulated in accordance with its program and data from pressure and temperature sensors. Two other instruments were installed on the stations' landing modules. Aerosols in Venus' cloud cover were analyzed with the aid of the first of these instrumetns, the ISAV-A. It was equipped for this purpose with a highly sophisticated and precise optical system with its own light source. The second instrument, the ISAV-S, was intended for analyzing the gas composition of Venus' atmosphere by the method of active spectrophotometry. Data was gathered by these instruments during the modules' descent to the surface of Venus. All of this information was electronically processed and transmitted to a Vega station, which relayed it to Earth. G.L.C.

N86-14155# Joint Publications Research Service, Arlington, Va.
BROCHURE ON PHOBOS AND DEIMOS c91
Vladimir Naumovich Zharkov and Aleksandr Vasilyevich Kozenko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 62-65 Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhn.: Ser. Kosmonavtika, Astron. (Moscow), no. 1, Jan. 1985 p 2-6, 53-54 (For primary document see N86-14111 04-88)
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The rotation of Phobos and Deimos is synchronous with the planet, i.e., they always face Mars with the same side. The orbits of the Martian satellites are almost circular; the eccentricity being .015 + or - .001 for Phobos and .0005 + or - .0003 for Deimos. They are also practically in the same plane as Mars' equator, that of Phobos being tilted at 1.02 deg and Deimos 1.82 deg. Semi-major axes of the orbits are 9378.5 and 23,459 km and orbital periods 7h 39 min and 30h 21 min, respectively. Thus, Phobos, while revolving around Mars, moves faster than the daily rotation of the planet, and for a Martian observer it would rise in the west and set in the east. G.L.C.

N86-14156# Joint Publications Research Service, Arlington, Va.
RESULTS OF STUDY OF SURFACE OF FIVE REGIONS ON VENUS BY BISTATIC RADAR METHOD Abstract Only c91
A. I. Kucheryavenkov, O. Ye. Milekhin, A. G. Pavelyev, and O. I. Yakovlev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 66-67 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 895-905 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A method for processing data from a bistatic radar was improved in order to obtain information on the surface of individual regions on Venus with a resolution substantially better than in the Pioneer-Venus experiment. The improved method made it possible to achieve a surface resolution of 5 to 20 km. In the bistatic radar observations made from Venera-10 the planetary surface was irradiated by monochromatic radio waves with a wavelength 32 cm. The transmitter was aboard the vehicle and registry of the direct signal and the signal reflected from the surface was performed at a ground station. Movement of the mirror reflection point on the Venusian surface caused by satellite motion relative to the planet made it possible to study regions adjacent to the trajectories of motion of a mirror reflection point. Five regions were explored. The first four were in the Southern Hemisphere and the fifth was in the Northern Hemisphere. Author

N86-14157# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF SPECTROSCOPIC DETECTION OF OXYGEN IN LOWER VENUSIAN ATMOSPHERE Abstract Only c91
V. A. Krasnopolskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 67-68 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 812-815 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The parameters of the Martian magnetic dipole on the basis of measurements from the Mars-2 satellite on 23 to 24 February 1972 were discussed. Although the experimental data have deficiencies (the satellite was without triaxial orientation and the interrogation of the vehicle was infrequent) the magnetograms contain important information. This is because during the 35 hours of measurements the satellite twice reached pericenter on the daytime side and twice reached the region of the magnetic tail on the nighttime side. Simultaneously with the measurements from the Mars-2 the magnetic field was measured from the high-apogee satellite Mars-3 (with triaxial orientation) in the free solar wind. Changes in the dynamic pressure of the solar wind during the time of the measurements were simple. The combined data made it possible to determine field topology, which is compared with the field topology near Venus and a model of a draped magnetosphere corresponding to the observed interplanetary magnetic field. Proof is given that Mars has its own magnetic field with a magnetic moment M sub M>1.5 x 10 to the 22 gauss. cubic cm, this constituting an effective obstacle to the solar wind. The strike of the magnetic tail was traced to 8 R sub M. The problems involved in determining orientation of the dipole on the basis of observations in the tail at distances 6 to 8 R sub M are discussed. On the assumption that a width of the Martian polar cap is approx. 45 deg it is estimated that the magnetic tail of the Martian magnetosphere can extend to 90 R sub M. The real obstacle to the solar wind near Mars is its magnetosphere, not its ionosphere. Near Mars there is an Earth-type, not a Venusian type of interaction with the solar wind. Author

N86-14158# Joint Publications Research Service, Arlington, Va.
ROSSBY AUTOSOLITON Abstract Only c34
S. V. Antipov, M. V. Nezlin, and A. S. Trubnikov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 68 Transl. into ENGLISH from Pisma v Zh. Eksperim. i Teor. Fiz. (Moscow), v. 41, no. 1, Jan. 1985 p 25-28 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A new nonlinear physical entity, a Rossby autosoliton, has been produced experimentally. It is an undamped, solitary, drifting, anticyclonic vortex which self-organizes in oppositely directed streams in rotating shallow water. It may be thought of as a steady-state soliton model of the Great Red Spot of Jupiter, developed experimentally for the first time. IAA

N86-14159# Joint Publications Research Service, Arlington, Va.
NATURE OF MEGACYCLES IN EVOLUTION OF EARTH, MARS, AND MOON Abstract Only c91
Ye. Ye. Milanovskiy and A. M. Nikishin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 69-70 Transl. into ENGLISH from Dokl. Akadem. Nauk SSSR (Moscow), v. 280, no. 5, Feb. 1985 p 1204-1209 Original language document announced in IAA as A85-28924 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

It is hypothesized that the evolution megacycles of the Earth, Mars, and the Moon began with bursts of tectonic-magmatic activity at both hemispheres, which was then focused in one of them. The specific character of newly formed structures in middle stages of the megacycle in the more active hemisphere depends on the intensity of endogenous processes, the horizontal displacement of asthenosphere matter, and the viscosity and thickness of the lithosphere. The final stage of a megacycle is total cooling of the planet (e.g., the Moon or Mars after the second megacycle), or a pause in its activity (e.g., Mars between the first and second megacycles), or an epoch of crustal cratonization (e.g., the Earth). IAA

N86-14160# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL LIFE-SUPPORT SYSTEMS FOR LONG-DURATION SPACE FLIGHTS c54
I. Andreyev and Yevgeniy Yakovlevich Shepelev *In its* USSR

Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 71-74 Transl. into ENGLISH from Izv. (Moscow), 11 Feb. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A brief overview of the necessary life support equipment requirements for long term space flights is presented. Self contained, closed, ecological systems for the generation of oxygen are presented as possibilities. G.L.C.

N86-14161# Joint Publications Research Service, Arlington, Va.
ARCHITECT DISCUSSES SPACE HABITAT DESIGNS c54
S. Zigunenko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 75-77 Transl. into ENGLISH from Pravda (Moscow), 4 Dec. 1984 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

General considerations for the interior design of spacecraft intended for long duration space flight were reviewed from a human factors engineering standpoint. It is important that those responsible for spacecraft design not allow their work to be overshadowed by their sense of gravity and the general restrictions of a terrestrial environment. G.L.C.

N86-14162# Joint Publications Research Service, Arlington, Va.
ENERGY EXCHANGE OF PLANTS UNDER WEIGHTLESSNESS CONDITIONS Abstract Only c51
M. G. Tairbekov and A. V. Devyatko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 80 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 280, no. 2, Jan. 1985 p 509-512 Original language document announced in IAA as A85-24193 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The plant energy-transfer experiment aboard the Cosmos-1514 biosatellite in December 1983 is considered. Heat release from corn sprouts was measured by a biocalorimeter operating in the 0 to 100 mW range. Results indicate that weightlessness has no effect on the intensity of energy transfer in sprouting seeds. The design of the biocalorimeter is described in some detail. IAA

N86-14163# Joint Publications Research Service, Arlington, Va.
STABILITY OF STATIONARY MOTIONS OF TWO TETHERED BODIES IN ORBIT UNDER INFLUENCE OF GRAVITATIONAL AND AERODYNAMIC FORCES Abstract Only c18
Ye. M. Levin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 81 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 675-682 Original language document announced in IAA as A85-15254 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The motion of a tethered system of two satellites in geometric orbit is examined. The main satellite is assumed to move in circular orbit at a height of 200 to 250 km above the Earth's surface, while the subsatellite-probe, attached to the main satellite by a thin tether, is assumed to orbit the Earth at a height of 100 to 150 km. In the dynamic analysis the subsatellite is considered as a material point, while the tether is considered as an extensible and ponderable flexible filament. Aerodynamic forces acting on the probe and tether are considered, and it is noted that the stationary motions of the system consist in its uniform revolution as a rigid body about the Earth. The stability of these stationary motions is analyzed, and it is shown that constraints imposed on the tether parameters by the stability requirement are more rigorous than constraints on tether strength. IAA

N86-14164# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL CHECKING OF MATHEMATICAL MODEL OF EDDY CURRENTS IN ACTUATING COMPONENTS OF SYSTEMS FOR MAGNETIC ORIENTATION OF ARTIFICIAL EARTH SATELLITES AND SPACECRAFT Abstract Only c17
V. G. Lebedev, B. I. Rabinovich, R. I. Ashkinazi, and S. V. Viktorov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 82 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 945-947 Original language document announced in IAA as A85-19914 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Rabinovich and Rogovoi (1984) developed a mathematical model with Volterra integrodifferential equations describing the dynamics of the electromagnet as the actuation element of a spacecraft stabilization system, taking into account the conductivity of the ferromagnetic core. The present paper describes an experimental verification of the adequacy of this model. The experiment involved the determination of the self-induction coefficient of the coil and the coefficient characterizing energy dissipation in the core. IAA

N86-14165# Joint Publications Research Service, Arlington, Va.
DETERMINING QUASI-REAL-TIME LOCATION OF SHIPS USING GEOSTATIONARY NAVIGATIONAL SATELLITES c04
V. E. Abdullayev, K. Kh. Ismalilov, V. N. Vintayev, and G. A. Sosunov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 83-89 refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR: Ser. Fiz.-Tekhn. i Mat. Nauk (Baku), v. 6, no. 1, Jan. - Feb. 1985 p 96-101 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Extensive work is being carried out and enormous funds are being expended on development of special space systems, which are based on the Doppler method of determining the location of ships from satellites moving along mid-altitude circular orbits, and which have good precision characteristics, to meet modern navigational requirements in precision, global coverage and speed, regardless of the time and climatic conditions of navigation. However, they all have a common deficiency, considerable time between observations. Based on the common trend in development of satellite systems of the last few years, one can assume the feasibility of developing a navigational system, consisting of satellites in a geostationary orbit, the constancy of coordinates and simplicity of observation of which make it possible to achieve a high saving due to use of the undoubtedly promising passive long-range method of determining the location of an object on the Earth's surface. The systems, the basis of which is the method of determining navigational data, are founded on the noninterrogation principle in which the navigational parameters are determined on a mobile object by comparing the signals received from the satellite to the signals of onboard oscillators. G.L.C.

N86-14166# Joint Publications Research Service, Arlington, Va.
ORGANIZATION OF SPACE NAVIGATION SYSTEM BASED ON USE OF GEOSTATIONARY SATELLITES c17
V. E. Abdullayev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 90-96 Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR: Ser. Fiz.-Tekhn. i Mat. Nauk (Baku), v. 5, no. 2, Mar. - Apr. 1984 p 144-149 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The modern navigation problem is inseparably related to the need for constant and operational support of the navigational personnel with meteorological, navigational and other types of information which could not possibly be provided without use of radio communications. The determination of a ship's position by such fundamental methods as observation of celestial bodies, the use of every possible radioelectronic and radar apparatus, is well known and has been developed in the form of an independent science called marine astronomy. However, with the appearance of present-day requirements, taking into account the high speeds of modern ships when there is a need at all times for reliable information on their position with an accuracy to a meter, all known marine astronomy methods are becoming greatly outmoded. Space navigation systems based on the Doppler method for determining the position of a ship by satellites moving in different circular orbits have good accuracy characteristics. However, a shortcoming of such systems is that the navigationl devices of a ship provide a correction of its position only in the period of presence of the transiting satellite in the zone of radiovisibility. For example, for the American Transit navigational system the mean time between observations at the equator is approximately 1.2 hours. G.L.C.

N86-14167# Joint Publications Research Service, Arlington, Va.
SPACE APPLICATIONS IN GEOLOGY Abstract Only c46
N. Lesnaya *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 102-103 Transl. into ENGLISH from Leninskoye Znamya (Moscow), no. 81, 7 Apr. 1985 p 2-3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Directions, methods and prospects of spacecraft-aided studies of the Earth in support of geology and mineral prospecting are reported. Author

N86-14168# Joint Publications Research Service, Arlington, Va.
PRESSURE FIELD RETRIEVAL BY REMOTE REFRACTOMETRY FROM SPACE Abstract Only c43
A. S. Gurvich and S. V. Sokolovskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 106 Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atm. i Okeana (Moscow), v. 21, no. 1, Jan. 1985 p 12-21 Original language document announced in IAA as A85-26291 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A preliminary evaluation of pressure-field reconstruction errors in remote refractometry from space is performed on the basis of a numerical experiment. The study isolates the effects of averaging along the refracted beam and the errors caused by the deviation of the real atmosphere from the spherically symmetric shape on the resulting meteorological parameters. It is demonstrated that with disturbances of horizontal dimensions of 300 to 600 km, vertical dimensions of 3 to 8 km, and pressure gradients characteristic of the Earth atmosphere on this scale the pressure-field reconstruction errors are under 0.3 percent. IAA

N86-14169# Joint Publications Research Service, Arlington, Va.
DETERMINING FLEXURE OF AERIAL CAMERA SMOOTHING GLASS Abstract Only c35
V. N. Lavrov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 107 Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 11, Nov. 1984 p 30-33 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Topographic aerial cameras are now in use in which the film is smoothed by being pressed against a smoothing glass on which a grid of fiducial marks is plotted. A significant pressure must be applied for good smoothing. Tests have shown that a pressure of 1.0 to 1.2 x 10 to the 4 Pa is adequate for ensuring a minimum gap between the film and the smoothing glass. The pressure required for smoothing the film causes elastic deformations (flexure) of the smoothing glass and connected parts of the aerial camera. Glass flexure must be taken into account during camera calibration in order to ascertain what photograph distortions could be a result of this bending. Author

N86-14170# Joint Publications Research Service, Arlington, Va.
STEREOPHOTOGRAMMETRIC SURVEY OF WAVE-COVERED WATER SURFACE Abstract Only c43
M. V. Shulmin, Yu. I. Kuchinskiy, and M. P. Shulmina *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 107-108 Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 11, Nov. 1984 p 33-35 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A methodology and some devices was developed for a stereophotogrammetric survey of a wave-covered water surface. This makes it possible to obtain and measure quite precisely a model of the investigated sector of a water body, the form, type and characteristics of the waves. A stereophotogrammetric survey of the wave-covered surface must be made simultaneously by two cameras. Enterprise No. 7, in collaboration with the Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, synchronized two 41/7.5 aerial cameras for this purpose. The methodology was worked out in water bodies in Kalinin Oblast where two test areas were established. Geodetic beacons of a special design were developed and fabricated for placement on the bottom of the water body for ensuring synchronization of the cameras at the time of the survey. The plane coordinates of the beacons were determined by trilateration. The adequate number of measurements ensured an accuracy in determining coordinates up to 1 mm. Elevations were determined by geometric leveling with errors up to 1 mm. Author

N86-14171# Joint Publications Research Service, Arlington, Va.
EQUATORIAL WAVES IN OCEAN SURFACE TEMPERATURE FIELD ACCORDING TO DATA FROM SHIPBOARD AND SATELLITE MEASUREMENTS Abstract Only c48
A. S. Kazmin, R. Legeckis, and K. N. Fedorov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 108-109 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 3-7 Original language document announced in IAA as A85-16940 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Legeckis (1977) has reported an existence of long waves in the eastern equatorial Pacific Ocean on the basis of data obtained with the aid of a geostationary satellite. The present investigation is concerned with data which confirm these observations. These data are the results of direct measurements of the sea surface temperatures conducted during a voyage of a Soviet research vessel in January 1982. A thermistor, representing a temperature-sensitive resistor device, kept at a depth in the range from 0.15 to 0.20 m was employed for the determination of the sea temperatures. The accuracy of the measurements was 0.05 C. The measured sea surface temperatures were shown in a graph as a function of the position of the ship at the time of measurement. Temperature data obtained on the basis of satellite data (NOAA/NESS) are also represented in the graph. The obtained data provide information regarding the hydrophysical characteristics of the equatorial front for the Northern Hemisphere in winter. There is satisfactory agreement between the two differently derived types of temperature data. IAA

N86-14172# Joint Publications Research Service, Arlington, Va.
USE OF REMOTE OPTICAL MEASUREMENTS IN AGRICULTURE Abstract Only c43
G. I. Belchanskiy, K. Ya. Kondratyev, V. V. Kozoderov, N. V. Sazonov, A. G. Topchiyev, and P. P. Fedchenko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 109-110 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 8-24 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In 1983 a number of organizations and institutes began joint work on use of remote measurement data obtained from aircraft and helicopters and ground data in the interests of agriculture. The program includes analysis of the factors influencing spectral reflectivity of soils and vegetation, development of methods for interaction between optical radiation and the soil-vegetation system, use of airborne spectrometric instrumentation for evaluating the chlorophyll content in plant leaves and determining the contamination of vegetation, surface studies of selected standard sectors of agricultural fields, regression analysis of data from surface photometric measurements and the parameters of the phytobiometric state of vegetation, organization of a data bank of spectral standards or keys and analysis of the possibilities of allowance for the distorting influence of the atmosphere. The fundamental theoretical premises for solution of these problems and some of the work done on solution of these problems are examined. Author

N86-14173# Joint Publications Research Service, Arlington, Va.
CLASSIFICATION OF TREES BY GROWTH CLASSES ON THE BASIS OF MULTIZONAL PHOTOGRAPHS Abstract Only c43
A. N. Borisov, V. A. Ivanov, G. A. Ivanchenko, V. S. Kirichuk, and V. V. Kuzmichev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 110 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 25-30 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The classification of tree stands has the purpose of evaluating their current status and future potential. The traditional, time-

consuming subjective surface methods used for this purpose can be replaced by remote multizonal surveys. A method for automating such work is presented. The method is illustrated using aerial photographs at 1:30,000 for sectors of pine stands taken in August using an MKF-6 camera, as well as surface land inventory data for the same test areas. The procedures for orientation and referencing of the photographs are described in detail. The use of the surface inventory data (coordinates of trees in test area, trunk diameter at height of 1.3 m (d), crown diameter (D), tree height (h), and height to maximum crown diameter (h sub D max)) are also used in the automated procedure. A correlation analysis of the two types of data is given. The information yield from the six spectral zones was studied. Since in ground surveys only the d and h parameters are usually used, it was concluded that three spectral zones would be adequate for obtaining comparable data. These three zones are sufficient for classifying the stand on the basis of degrees of depression. The results are correct for photographs of the scale used and the particular phenological phase of forest vegetation prevailing in August. Author

N86-14174# Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN COMPLEX MAPPING OF NATURAL RESOURCES IN AGRARIAN-INDUSTRIAL REGIONS OF NONCHERNOZEM RSFSR USING SPACE PHOTOMATERIALS Abstract Only **c43**
V. A. Sushchenya, L. A. Shevchenko, and V. I. Somova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 111 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 31-40 Original language document announced in IAA as A85-16941 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The following specialized maps must be prepared in the mapping of the natural resources of the Nonchernozem Zone using space photomaterials: natural conditions, present status of environment and resources, conservation of environment and predictions of possible changes in environment. In this zone the makeup of each series can be varied in dependence on the nature of the natural conditions in a specific region. Each series must be supported by a minimum of key maps whose compilation is obligatory for all regions in the Nonchernozem Zone for the purpose of ensuring rational planning of the use of natural resources and their possible restoration. One of the first experiments in compiling a set of maps on the basis of space photographs in two regions differing in natural conditions in Smolensk Oblast and Minsk Oblast (in which agricultural-forestry and agrarian-industrial economies predominate) is described. The compilation of such maps is described in detail. Author

N86-14175# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USE OF AEROSPACE MATERIALS IN PREDICTING OCCURRENCE OF PETROLEUM AND GAS Abstract Only **c43**
R. A. Bidzhiyev and L. M. Natapov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 112 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 41-50 Original language document announced in IAA as A85-16942 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In the last few years, aerospace methods have been increasingly employed in applications related to the search for petroleum and gas deposits. The present investigation is concerned with the utilization of aerospace data in a study of the northern part of Western Siberia. The consideration of such data can lead to a substantial reduction in expenses arising in connection with requirements for a use of seismic surveying procedures. Attention is given to the employed method of investigation, the utilized data material, information concerning the basic structure and the sedimentary mantle in the north of West Siberia, an analysis of details regarding aerospace data, and an evaluation of the obtained results. IAA

N86-14176# Joint Publications Research Service, Arlington, Va.
PROBLEMS IN STUDY AND EVALUATION OF CONSEQUENCES OF FOREST FIRES USING AEROSPACE PHOTOGRAPHS Abstract Only **c43**
V. V. Furyayev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 113 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 51-57 Original language document announced in IAA as A85-16943 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The problems involved in the evaluation of forest fires on the basis of aerospace photographs are discussed. The principal problems include developing principles and methods for studying the post-fire forest restoration process; formulation of principles and methods for the regionalization of taiga areas on the basis of the degree of damage by fires; working out of methods for the routine inventorying of areas of recently burned-over areas and determination of the post-fire state of forested areas; defining of principles and methods for evaluating potential damage to forested areas and their resistance to fires. The best time for such a survey is from June to August, during the period between total development of the canopy and prior to its autumn coloring. Solar altitude should be 25 deg or more and the cloud cover should not be greater than 10%. The periodicity of receipt of photoinformation for the compilation of maps of post-fire dynamics, maps of forest damage and maps of resistance to fires should be 10 to 12 years. This study requires the use of black-and-white, spectrozonal and multizonal photographs at scales 1:15,000, 1:100,000 and 1:1,000,000. Author

N86-14177# Joint Publications Research Service, Arlington, Va.
COMPUTATION OF REFLECTION OF SOLAR RADIATION FROM VEGETATION COVER BY MONTE-CARLO METHOD Abstract Only **c43**
Yu. K. Ross and A. L. Marshak *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 114 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 58-67 Original language document announced in IAA as A85-16944 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The establishment of the theoretical principles concerning the probing of the plant cover requires a rather detailed examination of biogeophysical problems regarding the reflection of solar radiation from soil and vegetation. Details with respect to the reflection of solar radiation from the plant cover are determined by illumination conditions, the optical properties of soil and plant cover, and structural aspects of the plant cover. Attention is given to a model of the plant structure, the mathematical formulation of the problem, details regarding the employed Monte Carlo method, an appraisal of the accuracy of the Monte Carlo method, and considerations of optimality and probability. Author

N86-14178# Joint Publications Research Service, Arlington, Va.
REFLECTION INDICATRICES OF VEGETATION CANOPIES Abstract Only **c43**
A. Kuusk, Ya. Anton, T. Nilson, U. Peterson, K. Ross, Yu. Ross, and A. Savikhin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 115 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 68-75 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A program is prepared for making in situ measurements to ascertain the extent to which the reflection indicatrices (reflectance factors) of different plant canopies differ from one another. Specialists at the Astrophysics and Atmospheric Physics Institute, Estonian Academy of Sciences, carry out measurements of the angular dependence of reflection of solar radiation from natural vegetation canopies and crops in several parts of the spectrum with high angular resolution. The angular dependence of the spectral brightness of vegetation canopies is determined using a narrow-angle aircraft telespectrophotometer mounted on a KA-26 helicopter. Measurements are made at the reflection maximum of the vegetation cover in the green part of the spectrum at

lambda = 0.555 microns, at the absorption maximum of chlorophyll at lambda = 0.675 microns and at the maximum reflection plateau lambda = 0.796 microns. The spectral ranges were discriminated by interference light filters with transmission half-widths of 13, 10 and 10 nm respectively. Measurements of the angular characteristics of reflection of fields and natural vegetation were made from a height of 50 microns in a stable illumination regime. Author

N86-14179# Joint Publications Research Service, Arlington, Va.
APPROXIMATE ANALYTICAL FORMULAS FOR COMPUTING SPECTRAL BRIGHTNESS COEFFICIENTS FOR AGRICULTURAL VEGETATION Abstract Only **c43**
T. Nilson and A. Kuusk *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 116 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 76-83 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Due to the recent vigorous development of aerospace optical sensing of vegetation a great need has arisen for effective theoretical models of the spectral brightness coefficients of vegetation canopies, especially agricultural vegetation. A model is proposed for formation of spectral brightness coefficients of agricultural crops in the form of approximate analytical formulas. The latter have an acceptable accuracy for all the principal regularities exerting an influence on the value of the spectral brightness coefficient. In the model it is assumed that the vegetation consists of randomly (in conformity to Poisson's law) distributed phytoelements with spherical orientation. The phytoelements reflect and transmit radiation in conformity to Lambert's law and it is assumed that the mirror component of radiation reflected directly from the surface waxy layer of the leaves, whose brightness is described by Fresnel's law, can be added to the reflection from the phytoelements. In this simplified model it is impossible to give a quantitatively correct description of absolutely all the effects associated with the temporal variation and angular dependence of the spectral brightness coefficient of agricultural vegetation. Author

N86-14180# Joint Publications Research Service, Arlington, Va.
METHOD FOR USING CLUSTERS IN EVALUATING LAND USE AREAS FROM MULTIZONAL PHOTOGRAPHS Abstract Only **c43**
L. N. Vasilyev and R. Kachinski *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 117 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 94-99 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In the study of agricultural landscapes the problem arises of clustering the results of measurement of multizonal images. In such surveys the spectral brightnesses of vegetation are continuously distributed in some interval and there is no natural cluster. The method developed and the results obtained in the classification of land use areas with cultivated vegetation on multizonal photographs based on an increase in the criterial space of spectral measurements with data on the spatial (geographical) distribution are described. Within the limits of a homogeneous landscape adjacent fields are occupied by different crops. The problem is solved under the condition that two adjacent fields occupied by crops belong to different classes, and this is used as a proximity test in the formalization of a cluster analysis model. The clustering method is applied in inventorying agricultural fields from multizonal space and aerial photographs. A statistical sampling with field clustering is used in the Telefoto-82 experiment executed under the Intercosmos program in the Polish People's Republic in the neighborhood of Wroclaw in July 1982. The results of clustering of 213 fields are presented. Author

N86-14181# Joint Publications Research Service, Arlington, Va.
METHODS FOR COMPLEX SPACE EXPERIMENT IN USSR FOR STUDYING LAND FROM MANNED SPACECRAFT Abstract Only **c43**
B. V. Vinogradov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 118 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 100-106 Original language document announced in IAA as A85-16946 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A combined space experiment involves use of surface, aerial and space vehicles and instrumentation. The implementation of such an experiment requires adherence to a number of rules relating to the comparability of data: temporal, spectral and spatial. In the USSR such experiments have become increasingly complex and have proceeded through the following states: (1) study of space survey transfer function (geophysical experiment in 1969-Ustyurt Plateau); (2) study of reliability and detail of recognition of natural features from space photographs (informational experiment in 1970-Salsk steppes); (3) study of effectiveness of special mapping, revision of existing maps and compilation of new types of maps (mapping experiment in 1971-Altay and Balkhash key sectors); (4) study of dynamics of natural and anthropogenic systems by successive surveys for registry and prediction of changes (dynamic experiment in 1978-Salsk key sector); and (5) study of rhythmic change in natural systems for registry of short-period changes, their prediction and choice of optimum survey conditions (phenological experiment in 1981-Kyzylkum key sector). Author

N86-14182# Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN CONDUCTING SUBSATELLITE EXPERIMENTS WITH WATER BODIES IN USSR AND HUNGARIAN PEOPLE'S REPUBLIC Abstract Only **c43**
I. F. Berestovskiy, A. A. Gitelson, D. Sabo, and F. Siladi *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 119 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 107-111 Original language document announced in IAA as A85-16947 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Subsatellite experiments were carried out in June 1983 at Lake Balaton in Hungary and in September 1983 in the Sea of Azov-Don River areas. The objectives included testing and perfecting of methods for interpretation of space information developed in joint research by USSR and Hungarian specialist; obtaining synchronous and quasisynchronous shipboard, aerial and satellite data needed in study of radiation-hydrophysical relationships and the formulation of systematic recommendations on remote determination of hydrochemical and hydrobiological indices of water bodies. Perfecting the methods and technological elements for speedy collection and primary processing of control information in test ranges were of the project. At Lake Balaton there is a test of the so-called direct algorithm for the interpretation of multizonal video-information. Spectral brightness in different channels are compared with the values of hydrochemical, hydrobiological and hydrooptical parameters measured synchronously in a space survey. Author

N86-14183# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USING SPACE SURVEY FOR STUDYING SEASONAL CHANGES OF LANDSCAPES IN SOME REGIONS OF USSR Abstract Only **c43**
I. N. Yelagin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 120 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 112-114 Original language document announced in IAA as A85-16948 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Of the northern regions of the European USSR, almost all of Siberia and the Far East are phenologically very poorly studied. It is virtually impossible to obtain necessary information rapidly in these regions by traditional surface methods. This dictates the use of aviation and artificial Earth satellites with the application of already developed remote phenology methods. The possibilities for the collection of such information in a space survey are examined. In the wooded steppe and taiga regions of Siberia the greatest number of days with a cloudless sky is in January to

March. However, space photographs taken at that time contain the minimum phenological information. In comparison with the winter months, a cloudless sky is very rare in spring, summer and autumn. In the months most suitable for remote phenology (May to August) only 10% of the days are reasonbly clear. In the more southerly, dry regions, such as central Asia, there are considerably more days with few clouds. In winter (November to February) the number of clear days varies in the range 20 to 35%; in summer (June to September) it is 50 to 70%. Accordingly, a phenological survey from space in these regions would have a high probability of success due to the great number of clear days. Author

N86-14184# Joint Publications Research Service, Arlington, Va.
ROLE OF LANDSCAPE RESEARCH IN DEVELOPMENT OF SPACE METHODS FOR STUDYING EARTH Abstract Only **c43**

Ye. V. Glushko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 121 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 5, Sep. - Oct. 1984 p 115-121 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

This is an overview of the contributions which space surveys are making to the development of the Earth sciences, with emphasis on landscape (geographical-environmental) research. Space methods are sweeping traditional methods away or are reducing them to a secondary role. Attention is given to 23 branches of the earth sciences with 82 key problems considered which can be investigated by remote sensing methods. The advantages of remote sensing in study of the atmosphere, hydrosphere, biosphere, sociosphere and in landscape geography are discussed. A table gives a detailed listing of the scientific, practical and economic problems which can be solved by space methods. References are made to the monographs, brochures, transactions, collections of articles and individual articles which give the best information concerning different aspects of these problems. Space methods have already served as a basis for a number of fundamental landscape investigations at a regional level. The landscape research method is now also being used in study of the geographical zonality of the world ocean. Author

N86-14185# Joint Publications Research Service, Arlington, Va.
METHODS FOR CONSTRUCTING ATMOSPHERIC OPTICAL TRANSFER OPERATOR Abstract Only **c46**

V. G. Zolotukhin, I. V. Mishin, D. A. Usikov, M. N. Fomenkova, and V. A. Grushin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 121-122 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 14-22 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Two methods for the construction of the optical transfer operator of the atmosphere are compared: the method of multiple reflections and the method of spatial-frequency characteristics. Calculation results are presented on the amplitude-frequency characteristics of the atmosphere with a real indicatrix and optical-thickness stratification with respect to altitude. B.J.

N86-14186# Joint Publications Research Service, Arlington, Va.
APPLICATION OF STATISTICAL MODEL OF LAYERED MEDIUM FOR COMPUTING THERMAL EMISSION OF ICE COVERS Abstract Only **c43**

V. L. Brekhovskikh *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 122-123 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 33-38 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In computing the thermal emission of a medium with the temperature T = const it is customary to use a formula based on the reciprocity theorem in which the brightness temperature T sub br is expressed through the coefficient of reflection (or absorption) of a plane wave incident on the particular medium: T sub br = T(1 -/R/2) or T sub br = TQ. Here /R/2 and Q are the energy coefficients for reflection and absorption, respectively. Such a theoretical approach, in the case of sufficiently smooth temperature changes is also applicable to nonuniformly heated bodies. A one-dimensional randomly inhomogeneous medium occupying the half-space - infinity $< z <$ or $= 0$ is examined. It is assumed that its dielectric constant is not dependent on temperature. It is shown that there are few difficulties in making analytical computations of the thermal emission of a semi-infinite layer whose dielectric constant changes randomly for interpretation of data from remote sensing of ice covers. The most suitable natural media to which the results can be applied are extensive ice formations such as the Antarctic continental glacier which have a layered structure and a relatively smooth surface. Author

N86-14187# Joint Publications Research Service, Arlington, Va.
COMPILATION OF LANDSCAPE MAPS AT DIFFERENT SCALES WITH USE OF SPACE PHOTOINFORMATION Abstract Only **c43**

V. I. Ryabchikova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 123 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 39-45 Original language document announced in IAA as A84-49029 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A methodology is being developed for the detailed mapping of natural resources and conditions on the basis of a series of special-purpose maps with the use of space photoinformation. A fundamental role is played by landscape maps which can serve as base maps. Their content is used in compiling a number of specialized maps, which include maps of vegetation, soils, ground water, geochemical characteristics and others. A detailed description of the preparation of a map compilation in all its aspects, including generalization, editing, legends, etc., is given. This is illustrated for a number of types of terrain in the Soviet subarctic: tundra accumulative plains, tundra mountain folded regions and mountains of intermediate elevation. These examples, prepared at different scales, illustrate the enormous amount of information which can be extracted from space photographs of areas which previously were so remote that their mapping was generally sketchy and unreliable. In addition, the use of space surveys reduces the time required for the preparation of landscape maps by a factor of 3 to 5. Author

N86-14188# Joint Publications Research Service, Arlington, Va.
USE OF SPACE GEOLOGICAL METHODS IN SEISMOTECTONIC RESEARCH Abstract Only **c46**

T. P. Ivanova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 124 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 46-52 Original language document announced in IAA as A84-49030 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The role of the geological analysis of space remote sensing images in a complex of geological-geophysical and seismotectonic observations in seismically dangerous areas is evaluated on the example of Fayzabad test region in Tadzhikistan. The interpreted lineaments are shown to correspond to gradient zones of deep-seated geophysical boundaries of the lithosphere; this helps to assess the morphology, kinematics, and seismic features of blocks of the Earth's crust. B.J.

N86-14189# Joint Publications Research Service, Arlington, Va.
ENGINEERING EVALUATION OF CRUSTAL FAULTS USING SPACE SURVEY DATA Abstract Only **c46**

A. L. Revzon *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 125 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 53-60 Original language document announced in IAA as A84-49031 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The interpretation of space photographs, on the basis of a geomorphological analysis of the images, makes it possible to give an engineering evaluation of faults whose reliability and completeness is considerably greater than the information obtained by engineering field work on the ground for selecting an optimum

variant of the layout of linear structures such as railroads, highways, tunnels, canals and pipelines. The interpretation of space photographs in combination with traditional methods results in the optimizing of such work and a decrease in work input and increase in the completeness of pertinent geological and engineering data, a choice of effective planning solutions in contending with fault zones, and warning of emergency situations when carrying out construction work. All this is illustrated in specific experience gained in such regions as along the Baykal-Amur Railroad and in the Caucasus in the latter case, for example, the completeness and accuracy of interpretation could be considered 100%. On-site geological and engineering work lacked the necessary volume of information on the presence of faults dangerous for construction.
Author

N86-14190# Joint Publications Research Service, Arlington, Va.
USE OF GOUDRIAAN MODEL FOR STUDYING REFLECTION REGULARITIES IN VEGETATION-SOIL SYSTEM IN OPTICAL RANGE. 1: INFLUENCE OF PHYTOMETRIC PARAMETERS ON SPECTRAL BRIGHTNESS COEFFICIENTS Abstract Only **c43**
N. N. Vygodskaya and I. I. Gorshkova *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 126 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 61-70 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

In a study of the reflectivity of the vegetation cover in the optical range it is best to use theoretical models of reflection of the vegetation-soil system based on the theory of radiation transfer in a turbid medium. The characteristics of some theoretical models of the radiation regime of the vegetation cover are discussed. One model discussed belongs to a class of models based on the theory of radiation transfer in a turbid homogeneous medium. The vegetation cover is simulated by a layer infinite in the horizontal direction with a random spatial distribution of phytoelements conforming to the Poisson law and consisting of m thin layers of a given thickness. Numerical experiments with this model make it possible to determine the type of dependence between the spectral brightness coefficient and the relative surface of the phytoelements for conditions of sighting to the nadir and a solar altitude greater than 55 deg. The practical application of the results requires the availability of catalogues of coefficients of spectral reflection of soils and individual phytoelements of plants prepared for different regions with allowance for possible changes in the states of soils and plants.
Author

N86-14191# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF SURVEY CONDITIONS AND EFFECT OF NOISE ON QUALITY OF SENSING OF SOIL FORMATIONS Abstract Only **c43**
A. B. Karasev and S. V. Pantyukhov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 127 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 71-80 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Numerical modeling of remote sensing of the soil cover in the visible spectral range is presented as a contribution to development of an improved remote aerospace method for studying soils. The authors use this model in examining the principal factors exerting an influence on quality of an image obtained by a survey system and characterized by the signal-to-noise (S/N) ratio and contrast. It is found, for example, that many types of soil formations which have experienced degradation, erosion or salinization are characterized by high S/N ratios relative to undergraded sectors. There is a wide range of optimum observation angles for which the S/N ratio and contrast are optimal. The magnitude and range of these angles are slightly dependent on solar zenith angle and change in optical thickness of the atmosphere; the observation angle at which the S/N ratio and contrast reach their maximum is not equal to the angle of the maximum spectral brightness value for the studied formation. Measurements of the coefficients of spectral brightness of natural formations must be accompanied by determinations of solar zenith angle and optical thickness of the atmosphere, as well as the reflection characteristics of the surrounding background.
Author

N86-14192# Joint Publications Research Service, Arlington, Va.
NORMALIZATION OF RESPONSE OF RADIOMETRIC INSTRUMENTATION FOR STUDYING EARTH'S NATURAL RESOURCES Abstract Only **c43**
G. K. Kholopov, R. Sh. Khisamov, and F. G. Khuzin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 128 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 81-88 Original language document announced in IAA as A84-49032 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A method for the normalization of the response of radiometers both on the basis of spectrozonal photometric parameters and on the basis of their spectral density at some mean wavelength is described. The practical use of this method reveals that it usually ensures a sufficient accuracy in measuring spectrozonal photometric parameters, such as the energy brightness of natural features illuminated by direct and scattered solar radiation. In a refinement of the method a fundamental change is a replacement of the real characteristic of absolute spectral response of each radiometer spectral zone, which is determined as a result of radiometer calibration and thereafter is considered known, by an idealized characteristic. An algorithm is outlined which takes into account the test of the minimum of the standard deviation of the idealized resultant spectral characteristic of the radiometer-measured source system from the real characteristic. In the normalization of the response of a multizonal radiometer intended for remote sensing of the Earth it is not the continuous spectrum which should be used, but some typical spectrum of the Earth's surface with allowance for the absorption lines of atmospheric gases.
Author

N86-14193# Joint Publications Research Service, Arlington, Va.
RADIOMETRIC CORRECTION OF MATERIALS OF AEROSPACE SURVEY OF EARTH WITH MKF-6 CAMERA: METHODOLOGY AND USE OF RESULTS Abstract Only **c43**
Kh. A. LopesFalkon *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 129 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 89-94 Original language document announced in IAA as A84-49033 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The transfer characteristics of the entire multizonal system of an aerospace survey (atmosphere - zonal - filter - objective - photographic film) have a distinct angular dependence relative to its main optical axis. This can result in a nonuniformity in light distribution over the frame field, the appearance of a central spot on photomaterials whose presence greatly lessens the possibilities for their quantitative digital processing and correct interpretation. This effect has been observed in countless cases, as in the joint USSR-Cuba TROPICO-3 space experiment on multizonal photographs of sugarcane fields, with serious resultant distortions. It is found that the nonuniformity of brightness distribution over the frame is essentially dependent on the number of the camera channels, varying from + or - 10 to + or - 25 from the mean brightness and sometimes is asymmetric relative to the center of the frame. This effect is the result of multiplicative noise attributable to the angular dependence of the parameters of the survey system and the scattering properties of the atmosphere. This can cause additional errors or even make image digital processing virtually impossible.
Author

N86-14194# Joint Publications Research Service, Arlington, Va.
SOME APPROACHES TO ORGANIZATION OF DATA BANK IN SYSTEM FOR STUDYING EARTH'S NATURAL RESOURCES FROM SPACE (USING EXAMPLE OF AGRICULTURE) Abstract Only **c43**
Yu. G. Simonov, N. F. Derevyanko, and G. I. Barvyn *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 130 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 103-109 Original language document announced

in IAA as A84-49035 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The problems involved in the logical and physical organization of data in a data bank of space information using the example of solution of problems in the processing of images in the interests of agriculture are discussed. Such a data bank oriented on the monitoring of agricultural production must ensure the possibility of accumulation and comparison of different kinds of data corresponding to administrative-economic units. Data must be organized in such a way as to ensure simple access to the information. The needs of two types of users must be satisfied: users seeking information from the bank directly from a terminal for the purpose of obtaining reference or statistical information relating to some administrative-economic units; programmers involved in processing images or working on automated mapping, using information from the data bank as a reference in the interpretation of current aerospace information, in an analysis of the dynamics of observed objects or phenomena and also for the purpose of compiling special maps. Author

N86-14195# Joint Publications Research Service, Arlington, Va.
EXPERIMENT FOR EVALUATING ACCURACY IN DETERMINING LAND CATEGORIES ON SPACE SCANNER PHOTOGRAPHS Abstract Only **c43**
R. I. Elman, Ye. V. Bakhtinova, A. N. Potapov, R. V. Sviridova, and L. A. Bersneva *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 131 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 110-119 Original language document announced in IAA as A84-49036 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

Consideration is given to the method and results of a computer experiment concerning the estimation of the accuracy with which land-use categories can be determined on space scanner images. The data examined were obtained with the Fragment multispectra scanner, and the experiment uses the SKANER program employing ASSEMBLER. The percentage of the correct recognition of test plots is taken as the accuracy estimation criterion of their selection. The experiment contains three series of tests: a comparison of two plot-recognition algorithms, estimation of the influence of the number of test plots, and estimation of the influence of fragment shift. The land-use category scheme obtained as the result of the experiment is presented. Author

N86-14196# Joint Publications Research Service, Arlington, Va.
REMOTE TEMPERATURE DETERMINATION OF TERRESTRIAL COVERS FROM POLARIZATION INVARIANT OF MICROWAVE-RADIOTHERMAL EMISSION Abstract Only **c43**
G. A. Andreyev, L. F. Borodin, L. V. Zayentsev, and S. N. Rubtsov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 132 Transl. into ENGLISH from Issled. Zemli iz Kosmosa (Moscow), no. 4, Jul. - Aug. 1984 p 120-123 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

It is proposed that the polarization invariant be used in determining the thermodynamic temperature of terrestrial covers T sub cov from aboard flight vehicles on the basis of the measured radiobrightness temperatures in vertical T sub ver and horizontal T sub hor polarizations at a sighting angle 45 deg using the expression T sub cov = T sub hor squared/squared T sub hor - T sub ver). Under real conditions the accuracy in determining temperature of surface features can be influenced by the width of the polar diagram of the receiving antenna, random surface irregularities, radiothermal emission of the atmosphere and possible variations of the sighting angle (pitching angle) during spaceflight. For example, the width of the receiving antenna polar diagram exerts no influence on the accuracy in determining the temperature of surface covers. On the other hand, the presence of random surface irregularities necessitates a correction of the polarization invariant. In order to reduce the error in determining T sub cov it is best to use the wavelength range in which there is little thermal emission; i.e., centimeter waves. It was found that the T sub cov error is minimum with an angle of about 43 deg. With this angle the error in determining temperature of pastures, concrete pavements and a lake surface does not exceed 3K in absolute value. Author

N86-14197# Joint Publications Research Service, Arlington, Va.
COMMENTS ON ANNIVERSARY OF APOLLO-SOYUZ FLIGHT **c12**
Ya. Golovanov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 133-139 Transl. into ENGLISH from Komsomolskaya Pravda (Moscow), 14 Jul. 1985 p 3-4 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

This year, 1985, marks the tenth anniversary of the joint United States - USSR space flight, the Apollo-Soyuz Test Project (ASTP). This high point in international cooperation is celebrated in the USSR with fond memories and hopes for a resumption of similar efforts in the future. A review of the apparent decline of NASA's fortunes over that decade makes it apparent to the writer that a revival of ASTP is all the more timely. He decries the advent of the Star Wars mentality and calls for a return to the more reasonable days of Apollo-Soyuz. F.M.R.

N86-14198# Joint Publications Research Service, Arlington, Va.
SOVIET-FRENCH COMMISSION DISCUSSES JOINT SPACE PROJECTS Abstract Only **c12**
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 140 Transl. into ENGLISH from NTR: Probl. i Resheniya (Moscow), no. 1, 28 May - 10 Jun. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

The 19th session of the permanent Mixed Soviet-French Commission, which was held in Paris, examined results and prospects of cooperation in basic and applied research, technology, economics, industry and agriculture, in line with the Long-term Program of Intensifying Economic, Industrial and Technical Cooperation for the Period 1980 to 1990. In particular, the commission noted with satisfaction that two projects in the field of gamma-astronomy -- Gamma-1 and Granat -- are in the process of being carried out. Spacecraft are to be launched in line with these projects in coming years. The French side also confirmed its participation in the Soviet project called Fobos, which is planned for the study of Mars and its moon Phobos. This mission is scheduled for 1988. Question of joint experiments during the mission of the next Soviet biological satellite were also discussed. In space meteorology and aeronomy, joint work is being done on the development and perfecting of scientific apparatus for studies of the lower ionosphere, and the possibility of conducting joint experiments on Soviet meteorological satellites is being examined. Author

N86-14199# Joint Publications Research Service, Arlington, Va.
LIST OF RECENT SOVIET SPACE LAUNCHES **c18**
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 141-143 Transl. into ENGLISH from various Russian articles (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

A list of recent Soviet space launches (21 March 1985 to 19 July 1985) with orbital parameters is given. The majority is in the Cosmos series (26 launches, two of which are multiple, Cosmos 1635 through 1642 (8), and Cosmos 1650 through 1652 (3); the list also includes an Ekran (TV broadcast satellite), Prognoz-10 (to study interplanetary and near-Earth shock waves caused by the interaction of the solar wind and Earth's magnetosphere -- a joint operation with Czechoslovakia), 2 Molniya-3's (communications satellites), the Soyuz T-13 (manned - docked with Salyut-7), and Progress-24 (made joint docking with Soyuz T-13 and Salyut-7). F.M.R.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-14200 Royal Observatory, Edinburgh (Scotland).
OCCASIONAL REPORTS OF THE ROYAL OBSERVATORY, EDINBURGH, NO. 16
1985 20 p refs
(ISSN-0309-099-X) Copyright. Avail: Issuing Activity

Observations and programs made by the Edinburg Royal Observatory are reported. Topics discussed include: (1) a multi-object fiber-optics coupler for the 1.2 m Schmidt telescope; (2) the plate scale of the Schmidt telescope; and (3) a large altazimuth Schmidt telescope design. For individual titles, see N86-14201 through N86-14203.

N86-14201 Royal Observatory, Edinburgh (Scotland).
A MULTIPLE-OBJECT FIBRE-OPTICS COUPLER FOR THE 1.2-m UK SCHMIDT TELESCOPE
F. G. Watson and J. A. Dawe (Australian National Univ., Coonabarabran, Australia) *In its* Occasional Repts. of the Royal Observatory, Edinburgh, No. 16 1985 p 1-7 refs (For primary document see N86-14200 04-89)
Copyright. Avail: Issuing Activity

The rationale for, and design of a spectrograph coupler for a wide-field astronomical telescope are presented, and then system performance was estimated. The coupler is fabricated at the UK Schmidt telescope. E.A.K.

N86-14202 Royal Greenwich Observatory, Hailsham (England).
THE PLATE SCALE OF THE U.K. SCHMIDT TELESCOPE
R. W. Argyle and P. R. Standen *In its* Occasional Repts. of the Royal Observatory, Edinburgh, No. 16 1985 p 9-13 refs (For primary document see N86-14200 04-89)
Copyright. Avail: Issuing Activity

Between 1973 November and 1981 January, 137 plates of the South Galactic Pole centered at RA = OOH 53m.0. Dec. = -28 deg 03' were taken with the U.K. Schmidt Telescope to derive positions, proper motions, parallaxes and photographic photometry for as many stars as possible. The plates were measured on the GALAXY measuring machine. Results for 800 stars with 8 - V > 1.2 and B < 17.5 are announced. A by-product of this work is the derivation of accurate plate scales for each plate. Standard coordinates from GALAXY x,y measurements are obtained by using a program GLASTR written for the Vax 11/75. The conversion is effected using the positions of 40 SAO stars well distributed over the 4.5 x 4.5 degree field available to GALAXY. E.A.K.

N86-14203 Australian National Univ., Coonabarabran.
DESIGN FOR A LARGE ALTAZIMUTH SCHMIDT TELESCOPE
J. A. Dawe and F. G. Watson (Royal Observatory, Edinburgh) *In* Royal Observatory Occasional Repts. of the Royal Observatory, Edinburgh, No. 16 1985 p 15-18 refs (For primary document see N86-14200 04-89)
Copyright. Avail: Issuing Activity

The construction of a large altazimuth Schimdt telescope (LAST), incorporating recent advances in telescope design and detector technology is discussed. The telescope represents a most cost-effective method of undertaking ground-based optical astronomy. A preliminary design for such an instrument is described. E.A.K.

N86-14204*# Chicago Univ., Ill.
FOCAL PLANE OPTICS IN FAR-INFRARED AND SUBMILLIMETER ASTRONOMY Preprint Series 40
Roger H. Hildebrand Oct. 1985 33 p refs
(Grant NsG-2057)
(NASA-TM-88186; Rept-86010; NAS 1.15:88186) Avail: NTIS HC A03/MF A01 CSCL 03A

The construction of airborne observatories, high mountain-top observatories, and space observatories designed especially for infrared and submillimeter astronomy has opened fields of research requiring new optical techniques. A typical far-IR photometric study involves measurement of a continuum spectrum in several passbands between approx 30 microns and 1000 microns and diffraction-limited mapping of the source. At these wavelengths, diffraction effects strongly influence the design of the field optics systems which couple the incoming flux to the radiation sensors (cold bolometers). The Airy diffraction disk for a typical telescope at submillimeter wavelengths approx 100 microns-1000 microns is many millimeters in diameter; the size of the field stop must be comparable. The dilute radiation at the stop is fed through a Winston nonimaging concentrator to a small cavity containing the bolometer. The purpose of this paper is to review the principles and techniques of infrared field optics systems, including spectral filters, concentrators, cavities, and bolometers (as optical elements), with emphasis on photometric systems for wavelengths longer than 60 microns. Author

N86-14205*# Columbia Univ., New York. Astrophysics Lab.
DETECTION OF [NI2] LAMBDA 7378 IN SIX SEYFERT GALAXIES
J. P. Halpern and J. B. Oke (California Inst. of Tech.) [1985] 20 p refs
(Grant NGL-05-002-134)
(NASA-CR-176358; NAS 1.26:176358) Avail: NTIS HC A02/MF A01 CSCL 03A

A line due to [Ni 2] 7378 in the Seyfert galaxies NGC 1068, 2110, 3227, 4151, 5506, and Arp 102 B was detected. The average Ni abundance is about 2 times solar, which is 5 times less than in the filaments of the Crab Nebula. This argues for nucleosynthetic processing in the latter. The [Ni 2] line is spatially revolved in NGC 1068, and shows at least a factor of 4 enhancement in the Ni abundance away from the nucleus. The off-nuclear abundance of Ni in NGC 1068 approaches that of the Crab, which strongly suggests that type supernovae enriched the off-nuclear gas clouds. Author

N86-14206*# Lockheed Missiles and Space Co., Palo Alto, Calif.
AN UNBIASED X-RAY SAMPLING OF STARS WITHIN 25 PARSECS OF THE SUN Final Report
Hugh M. Johnson 15 Aug. 1985 32 p refs
(Contract NAS8-36134)
(NASA-CR-178544; NAS 1.26:178544) Avail: NTIS HC A03/MF A01 CSCL 03A

A search of all of the Einstein Observatory IPC and HRI fields for untargeted stars in the Woolley, et al., Catalogue of the nearby stars is reported. Optical data and IPC coordinates, flux density F sub x, and luminosity L sub x, or upper limits, are tabulated for 126 single or blended systems, and HRI results for a few of them. IPC luminosity functions are derived for the systems, for 193 individual stars in the systems (with L sub x shared equally among blended components), and for 63 individual M dwarfs. These stars have relatively large X-ray flux densities that are free of interstellar extinction, because they are nearby, but they are otherwise unbiased with respect to the X-ray properties that are found in a defined small space around the Sun. Author

N86-14207# Arizona Univ., Tucson.
SPECKLE IMAGE RECONSTRUCTION. APPENDIX 1 Final Report
P. A. Strittmatter and E. K. Hege 1 Apr. 1985 56 p
(Contract F19628-82-K-0025; Grants NSF AST-81-13212; NSF AST-82-01092)
(AD-A158271; AFOSR-85-0635TR-App-1) Avail: NTIS HC A04/MF A01 CSCL 03/2

By adjusting the optical pathlengths of the MMT (Multiple Mirror Telescopes) telescopes, it is possible to make the MMT into a phased array with a 6.86 m baseline. A coherent, phased focus can be achieved with tilted focal planes if the tilt angle is chosen so that the internal phase differences exactly compensate the external phase differences. This amounts to a slight change in configuration such that the beams are brought together at f/8.39 rather than the originally designed f/9. We summarize experiments which have used the MMT subapertures as a phased

array and as a coherent, phased telescope, and present a simple analysis of the tilted focal plane geometry for coherent observation. The phased operation of the MMT is important not only for obtaining high angular resolution, but also for obtaining the higher detection sensitivity which results from the better discrimination against the sky emission background for infrared diffraction limited images. Full-aperture (six-beams), diffraction-limited results for the unresolved source Gamma Orinois, the well-known close binary Capella and the resolved red supergiant Betelgeuse, (including a diffraction limited differential speckle image of the latter) are presented. GRA

N86-14208# Arizona Univ., Tucson.
SPECKLE IMAGE RECONSTRUCTION. APPENDIX 2 Final Report
P. A. Strittmatter and E. K. Hege 1 Apr. 1985 322 p
(Contract F19628-82-K-0025; Grants NSF AST-81-13212; NSF AST-82-01092)
(AD-A158272; AFOSR-85-0635TR-App-2) Avail: NTIS HC A14/MF A01 CSCL 03/1

Partial contents include: Size Measurement of a Geosynchronous Satellite Using the MMT (Multiple Mirror Telescope); Speckle Interferometry of Asteroids; High-Speed Digital Signal Processing for Speckle Interferometry; Seeing Calibration of Optical Astronomical Speckle Interferometric Data; Seeing Studies for Speckle Holographic Imaging; A Self Calibrating Shift-and-Add Technique for Speckle Imaging; Physical Diameter and Images of Alpha Orionis; Image Reconstruction from Astronomical Speckle Interferometry; Recovery of Binary Star Orientation and Relative Intensity-A comparison of Techniques; Maximum Magnitude Estimation of Object's Power Spectrum In Stellar Speckle Interferometry; The Differential Speckle Interferometer; Statistical Analysis of the Self-Calibrating Shift-and-Add Image Reconstruction Technique; Adaptive Optics. GRA

N86-14092*# Southwestern Univ., Georgetown, Tex.
LUNAR LUMINESCENCE MEASUREMENTS Final Report
Thomas H. Morgan *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 11 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-14209*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
EXTENDED ATMOSPHERES OF OUTER PLANET SATELLITES AND COMETS Interim Report, Aug. - Oct. 1985
William H. Smyth and Michael R. Combi Nov. 1985 10 p refs
(Contract NASw-3966)
(NASA-CR-176398; NAS 1.26:176398) Avail: NTIS HC A02/MF A01 CSCL 03B

The new cometary hydrogen particle-trajectory model, completed last year, has been used successfully to analyze observations of Comet P/Giacobini-Zinner. The Pioneer Venus Orbiter Ultraviolet Spectrometer observed the comet at 1216 A (hydrogen Lyman-a) on 11 September 1985 when the comet was 1.03 AU from the Sun and 1.09 AU from Venus. The analysis implies a production rate at 1.03 AU 2.3 x 10 to the 28th power/sec of the water molecules which photodissociate to produce the observed hydrogen. An upper limit for the H2O production rate of Comet P/Halley of 5 x 10 to the 28th power/sec at 2.60 AU was also obtained from the Pioneer Venus instrument. Author

N86-14210# Naval Academy, Annapolis, Md.
INVESTIGATION OF DUST ASSOCIATED WITH SHELL STARS Final Report, 1984 - 1985
M. S. Boehle 9 May 1985 124 p
(AD-A158945; USNA-TSPR-131) Avail: NTIS HC A06/MF A01 CSCL 03/2

This project investigated the association of dust with shell stars. Shell stars are identified by emission lines in their spectra, which have been produced in a shell of hot gas surrounding the star. Additional observed properties have indicated the presence of dust, but the direct association of dust with individual shell stars has not been demonstrated conclusively. The first phase of this project was designed to show the presence of dust around the two shell stars, and the second phase investigated their variability. The technique used for both phases was photoelectric photometry. Two sets of filters, broad band and narrow band, were used, in two photometers. The color index obtained from the broad band filters can detect the effects of dust on the star's light and, when compared to neighboring stars, can show whether the dust is directly associated with the star. Variability was searched for, using both sets of filters. AB Aurigal was not found to have a significant amount of circumsteller dust, but FS Canis Major has a strong indication of circumsteller dust and its observed variability has been shown to be a result of its circumsteller dust shell and not any variation of its actual physical properties. GRA

N86-14211# Los Alamos National Lab., N. Mex.
PREPARATION, ANALYSIS AND RELEASE OF SIMULATED INTERPLANETARY GRAINS INTO LOW GRAIN ORBIT
J. R. Stephens, I. E. Strong, and T. D. Kunkle 1985 7 p Presented at the Workshop on the Inter-Relationship Among Interstellar, Circumstellar and Interplanetary Grains, Wye, Md., 27 Feb. 1985 (Contract W-7405-eng-36)
(DE85-014133; LA-UR-85-1979; CONF-850287-1) Avail: NTIS HC A02/MF A01

Astronomical observations which reflect the optical and dynamical properties of interstellar and interplanetary grains are the primary means of identifying the shape, size, and the chemistry of extraterrestrial grain materials. The formation and optical characterization of simulated interstellar and interplanetary dust with particular emphasis on studying the properties on irregularly shaped particles are studied, as well as efforts to develop the techniques to allow dust experiments to be carried out in low-Earth orbit, thus extending the conditions under which dust experiments may be performed. The objectives are threefold: (1) to elucidate the optical properties, including scattering and absorption, of simulated interstellar grains including SiC, silicates, and carbon grains produced in the laboratory; (2) to develop the capabilities to release grains and volatile materials into the near-Earth environment and study their dynamics and optical properties; and (3) to study the interaction of released materials with the near-Earth environment to elucidate grain behavior in astrophysical environments. Interaction of grains with their environment may, for example, lead to grain alignment or coagulation, which results in observable phenomena such as polarization of light or a change of the scattering properties of the grains. DOE

N86-14087*# Saint Thomas Univ., Houston, Tex. Dept. of Physics.
SOME APPLICATIONS OF LIE GROUPS IN ASTRODYNAMICS Final Report
A. A. Jackson *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 10 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03B

N86-14093*# Sam Houston State Univ., Huntsville, Tex. Dept. of Physics.
DEVELOPMENT OF A MASS SPECTROMETER SYSTEM FOR THE MEASUREMENT OF INERT GASES IN METEORITES Final Report
Russell L. Palma *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 9 p (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03B

N86-14112# Joint Publications Research Service, Arlington, Va.
FORMING TRANSFORMATION MATRICES FOR DIFFERENT PARAMETERS OF MOTION OF CELESTIAL BODIES Abstract Only
A. A. Sukhanov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 24 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 819-827 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14113# Joint Publications Research Service, Arlington, Va.
FORMING ATTAINABILITY SETS IN CONTROL OF KINETIC MOMENT OF ROTATING ASYMMETRIC SOLID BODY (SPECIAL CASES) Abstract Only
A. V. Sarychev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 25 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 828-841 Original language document announced in IAA as A85-19902 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14120# Joint Publications Research Service, Arlington, Va.
ROLE OF INTRINSIC ENERGY SOURCE IN PHYSICAL BEHAVIOR OF SPLIT COMETARY NUCLEUS Abstract Only
V. D. Davydov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 31 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 922-941 Original language document announced in IAA as A85-19912 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14121# Joint Publications Research Service, Arlington, Va.
APPROXIMATE SOLUTIONS OF EULER-LAMBERT EQUATION FOR CASE OF SEVERAL REVOLUTIONS ABOUT CENTRAL BODY Abstract Only
L. B. Livanov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 32 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 942-944 Original language document announced in IAA as A85-19913 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14131# Joint Publications Research Service, Arlington, Va.
INTEGRATION OF EQUATIONS OF MOTION FOR MATERIAL POINT IN GRAVITATIONAL FIELD OF AXIALLY SYMMETRIC PLANET Abstract Only
A. R. Golikov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 39 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 651-662 Original language document announced in IAA as A85-15252 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14132# Joint Publications Research Service, Arlington, Va.
PERIODIC REGIMES OF ROTATIONAL MOTION OF SOLID BODY ABOUT LIBERATION POINT L SUB 4 IN RESTRICTED ELLIPTICAL THREE-BODY PROBLEM Abstract Only
Yu. V. Barkin and S. N. Lelyavin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 40 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 663-674 Original language document announced in IAA as A85-15253 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14141# Joint Publications Research Service, Arlington, Va.
DEPENDENCE OF LENGTH OF FREE PATH OF FLARE PARTICLES ON ENERGY Abstract Only
Ye. I. Daybog, Viktoriya G. Kurt, and V. G. Stolpovskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 46-47 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 763-773 Original language document announced in IAA as A85-15263 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14147# Joint Publications Research Service, Arlington, Va.
WAVE INTERPRETATION OF MEASUREMENTS ON MARS-7 AND VENERA-9 PROBES FOR DETERMINING VELOCITY OF MOTION OF INTERSTELLAR GAS Abstract Only
Ye. M. Grivnev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 51 Transl. into ENGLISH from Pisma v Astron. Zh. (Moscow), v. 10, no. 12, Dec. 1984 p 908-911 Previously announced in IAA as A85-39191 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N86-14212*# Boeing Aerospace Co., Seattle, Wash.
EXPERIMENTAL INVESTIGATION OF CRATER GROWTH DYNAMICS
Robert M. Schmidt, Kevin R. Housen, Michael D. Bjorkman, and Keith A. Holsapple 1985 5 p refs
(Contract NASw-3291)
(NASA-CR-176392; NAS 1.26:176392) Avail: NTIS HC A02/MF A01 CSCL 03B

This work is a continuation of an ongoing program whose objective is to perform experiments and to develop scaling relationships for large-body impacts onto planetary surfaces. The centrifuge technique is used to provide experimental data for actual target materials of interest. With both power and gas guns mounted on the rotor arm, it is possible to match various dimensionless similarity parameters, which have been shown to govern the behavior of large-scale impacts. The development of the centrifuge technique has been poineered by the present investigators and is documented by numerous publications, the most recent of which are listed below. Understanding the dependence of crater size upon gravity has been shown to be key to the complete determination of the dynamic and kinematic behavior of crater formation as well as ejecta phenomena. Three unique time regimes in the formation of an impact crater have been identified. B.W.

N86-14086*# East Carolina Univ., Greenville, N.C.
NUTRITIONAL CHARACTERISTICS OF MOON DUST FOR SOIL MICROORGANISMS Final Report
Takeru Ito *In* NASA. Johnson (Lyndon B.) Space Center The 1983 NASA/ASEE Summer Faculty Fellowship Research Program Research Reports Sep. 1983 17 p refs (For primary document see N86-14078 04-85)
Avail: NTIS HC A18/MF A01 CSCL 03B

N86-14128# Joint Publications Research Service, Arlington, Va.
APPROXIMATE CLUSTER ANALYSIS METHOD AND THREE-DIMENSIONAL DIAGRAM OF OPTICAL CHARACTERISTICS OF LUNAR SURFACE Abstract Only
N. N. Yevsyukov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 37 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1184-1191 Previously announced in IAA as A85-42342 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14143# Joint Publications Research Service, Arlington, Va.
ELECTRICAL AND ELECTROTHERMAL CONDUCTIVITY OF PLANETARY IONOSPHERES. 1: REFINEMENT OF THEORY Abstract Only
A. V. Pavlov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 48-49 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 781-791 Original language document announced in IAA as A85-15265 (For primary

document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14148# Joint Publications Research Service, Arlington, Va.
VEGA-1 RELEASES AEROSTAT AND LANDER AT VENUS
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 52-53 Transl. into ENGLISH from Komsomolskaya Pravda (Moscow), 12 Jun. 1985 p 1 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14149# Joint Publications Research Service, Arlington, Va.
OBJECTIVES OF VEGA PROJECT RESEARCH Abstract Only
T. Breus *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 54 Transl. into ENGLISH from Kommunist (Moscow), 13 Jun. 1985 p 4 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14150# Joint Publications Research Service, Arlington, Va.
VEGA-2 RELEASES AEROSTAT AND LANDER AT VENUS
In its USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 55-56 Transl. into ENGLISH from Komsomolskaya Pravda (Moscow), 16 Jun. 1985 p 1 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14151# Joint Publications Research Service, Arlington, Va.
RESULTS FROM VEGA ATMOSPHERE AND SOIL STUDIES Abstract Only
V. Golovachev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 57 Transl. into ENGLISH from Trud (Moscow), 16 Jun. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14152# Joint Publications Research Service, Arlington, Va.
PRESS CONFERENCE ON FIRST STAGE OF VEGA PROJECT
V. P. Ovcharov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 58-59 Transl. into ENGLISH from Sov. Latviya (Riga), 18 Jun. 1985 p 3 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14153# Joint Publications Research Service, Arlington, Va.
FURTHER COMMENTS ON RESULTS OF VEGA STUDIES OF VENUS Abstract Only
A. Pokrovskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 60 Transl. into ENGLISH from Pravda (Moscow), 1 Jul. 1985 p 3 (For primary document see N86-14111 04-88)
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N86-14155# Joint Publications Research Service, Arlington, Va.
BROCHURE ON PHOBOS AND DEIMOS
Vladimir Naumovich Zharkov and Aleksandr Vasilyevich Kozenko *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 62-65 Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhn.: Ser. Kosmonavtika, Astron. (Moscow), no. 1, Jan. 1985 p 2-6, 53-54 (For primary document see N86-14111 04-88)
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N86-14156# Joint Publications Research Service, Arlington, Va.
RESULTS OF STUDY OF SURFACE OF FIVE REGIONS ON VENUS BY BISTATIC RADAR METHOD Abstract Only
A. I. Kucheryavenkov, O. Ye. Milekhin, A. G. Pavelyev, and O. I. Yakovlev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 66-67 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 895-905 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14157# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF SPECTROSCOPIC DETECTION OF OXYGEN IN LOWER VENUSIAN ATMOSPHERE Abstract Only
V. A. Krasnopolskiy *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 67-68 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 812-815 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14159# Joint Publications Research Service, Arlington, Va.
NATURE OF MEGACYCLES IN EVOLUTION OF EARTH, MARS, AND MOON Abstract Only
Ye. Ye. Milanovskiy and A. M. Nikishin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 69-70 Transl. into ENGLISH from Dokl. Akadem. Nauk SSSR (Moscow), v. 280, no. 5, Feb. 1985 p 1204-1209 Original language document announced in IAA as A85-28924 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-14119# Joint Publications Research Service, Arlington, Va.
SOLAR FLARE X-RADIATION AND HIGH-ENERGY PARTICLES ACCORDING TO OBSERVATIONAL DATA FROM VENERA-13 AND VENERA-14 AUTOMATIC INTERPLANETARY STATIONS Abstract Only
S. A. Belyakov, Ye. I. Daybog, A. P. Dyachkov, V. M. Zenchenko, Viktoriya G. Kurt, Yu. I. Logachev, A. I. Rutkovskiy, S. P. Ryumin, V. G. Stolpovskiy, V. G. Yurovitskaya et al *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 30 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 906-921 Original language document announced in IAA as A85-19911 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14124# Joint Publications Research Service, Arlington, Va.
SUDDEN DISAPPEARANCE OF QUIESCENT PROMINENCES Abstract Only
G. P. Apushkinskiy and N. A. Topchilo *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 34 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1150-1157 Original language document announced in IAA as A85-42338 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14125# Joint Publications Research Service, Arlington, Va.
MAGNETIC FIELD DETERMINATION IN QUIESCENT SOLAR PROMINENCES FROM POLARIZATION CHARACTERISTICS OF RADIATED LIGHT Abstract Only
M. G. Gornyy, D. V. Kupriyanov, and B. G. Matisov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 35 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1158-1167 Previously announced in IAA as A85-42339 (For primary document see N86-14111 04-88)
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SPATIAL PATTERNS OF MANIFESTATION OF SOLAR ACTIVITY IN TROPOSPHERE Abstract Only
R. V. Smirnov *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 35-36 Transl. into ENGLISH from Astron. Zh. (Moscow), v. 61, no. 6, Nov. - Dec. 1984 p 1168-1178 Previously announced in IAA as A85-42340 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14142# Joint Publications Research Service, Arlington, Va.
OBSERVATION OF SMALL-SCALE SOLAR WIND STRUCTURE ON FRONT OF SHARP INCREASE IN PLASMA FLOW VELOCITY Abstract Only
L. A. Avanov, G. N. Zastenker, O. L. Vaysberg, and Yu. I. Yermolayev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 47-48 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 774-780 Original

language document announced in IAA as A85-15264 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

N86-13792# Joint Publications Research Service, Arlington, Va.
LATITUDE MEASUREMENTS OF COSMIC RADIATION INTENSITY IN STRATOSPHERE AND AT SEA LEVEL ON MARINE ANTARCTIC EXPEDITIONS Abstract Only
Nikolay Savvich Svirzhevskiy *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 39 Transl. into ENGLISH from "Shirotnyye Izmereniya Intensivnosti Kosmicheskogo Izlucheniya v Stratosfere i na Urovne Morya v Morskikh Antarkticheskikh Ekspeditsiyakh" Moscow, 1983 p 1-16 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-13793# Joint Publications Research Service, Arlington, Va.
HADRON COMPONENT OF COSMIC RADIATION AT ATMOSPHERIC DEPTH 800 g/cm(2) IN ENERGY RANGE 70 TO 700 GeV Abstract Only
Petr Sergeyevich Vasilyev *In its* USSR Rept.: Earth Sci. (JPRS-UES-85-009) 13 Nov. 1985 p 40 Transl. into ENGLISH from "Adronnaya Komponenta Kosmicheskogo Izlucheniya na Glubine Atmosfery 800 g/cm(2) v Oblasti Energiy (70-700GeV)" Moscow, 1984 p 1-20 (For primary document see N86-13765 04-42)
Avail: NTIS HC A04/MF A01

N86-14118# Joint Publications Research Service, Arlington, Va.
SPECTRUM OF PHOTOELECTRONS IN EARTH'S UPPER ATMOSPHERE DURING SOLAR FLARES Abstract Only
S. V. Avakyan and G. S. Kudryashev *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 29 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 889-894 Original language document announced in IAA as A85-19909 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

N86-14122# Joint Publications Research Service, Arlington, Va.
FORMATION OF HIGH-ENERGY SECONDARY ELECTRONS IN LOW-DENSITY MEDIUM AT GREAT ALTITUDES Abstract Only
L. V. Kurnosova, L. A. Razorenov, and M. I. Fradkin *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 32-33 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 947-949 Original language document announced in IAA as A85-19915 (For primary document see N86-14111 04-88)
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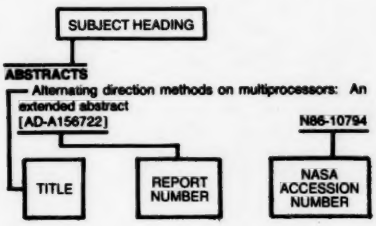
N86-14123# Joint Publications Research Service, Arlington, Va.
HARD GAMMA RADIATION BACKGROUND FROM CODING COLLIMATOR OF GAMMA TELESCOPE UNDER SPACE EXPERIMENT CONDITIONS Abstract Only
A. P. Aleksandrov, A. N. Berezovoy, A. M. Galper, V. M. Grachev, V. V. Dmitrenko, V. G. Kirillov-Ugryumov, V. V. Lebedev, V. A. Lyakhov, A. A. Moiseyev, S. Ye. Ulin et al *In its* USSR Rept.: Space (JPRS-USP-85-005) 30 Sep. 1985 p 33-34 Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 22, no. 6, Nov. - Dec. 1984 p 950-951 (For primary document see N86-14111 04-88)
Avail: NTIS HC A08

99 GENERAL

N86-14213*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EMERGING AEROSPACE TECHNOLOGIES
William F. Ballhaus, Jr. and Laurance A. Milov Sep. 1985 16 p refs
(NASA-TM-86837; Rept-85409; NAS 1.15:86837) Avail: NTIS HC A02/MF A01 CSCL 05D

The United States Government has a long history of promoting the advancement of technology to strengthen the economy and national defense. An example is NASA, which was formed in 1958 to establish and maintain U.S. space technology leadership. This leadership has resulted in technological benefits to many fields and the establishment of new commercial industries, such as satellite communications. Currently, NASA's leading technology development at Ames Research Center includes the Tilt Rotor XV-15, which provides the versatility of a helicopter with the speed of a turboprop aircraft; the Numerical Aerodynamic Simulator, which is pushing the state of the art in advanced computational mathematics and computer simulation; and the Advanced Automation and Robotics programs, which will improve all areas of space development as well as life on Earth. Private industry is involved in maintaining technological leadership through NASA's Commercial Use of Space Program, which provides for synergistic relationships among government, industry, and academia. The plan for a space station by 1992 has framed much of NASA's future goals and has provided new areas of opportunity for both domestic space technology and leadership improvement of life on Earth. Author

Typical Subject Index Listing



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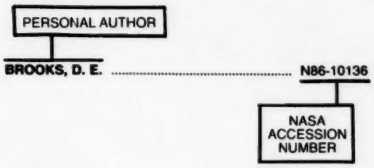

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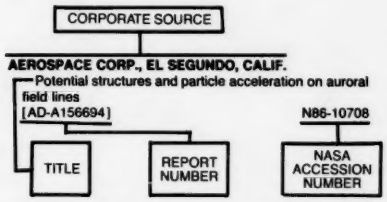

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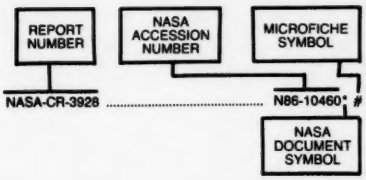

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